New York State Museum Bulletin

Published by The University of the State of New York

No. 336 ALBANY, N. Y. JUNE 1944

NEW YORK STATE MUSEUM

CHARLES C. ADAMS, *Director*

GEOLOGY OF THE CATSKILL AND KAATERSKILL QUADRANGLES

PART II SILURIAN AND DEVONIAN GEOLOGY, WITH A CHAPTER ON GLACIAL GEOLOGY

By

GEORGE H. CHADWICK

Temporary Geologist, New York State Museum

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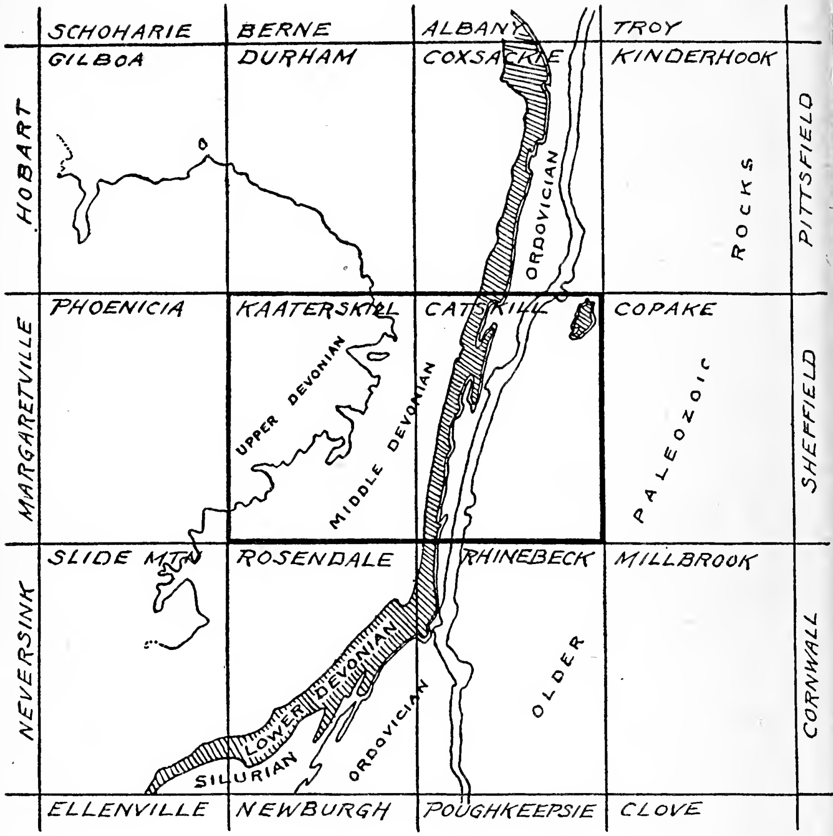
ILLUSTRATIONS



Key map showing the relation of the Catskill-Kaaterskill quadrangles to the ten surrounding quadrangles geographically and geologically.

Geological maps and bulletins have been issued for the Schoharie, Berne, Albany-Troy, Newburgh and Poughkeepsie quadrangles; Coxsackie is being published.

The cross-lined belt marked "Lower Devonian" is actually the Kalk berg and thus includes also the (Middle Devonian) Onondaga limestone.

GEOLOGY OF THE CATSKILL AND KAATERSKILL QUADRANGLES

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PREFACE AND ACKNOWLEDGMENTS

When, in 1926, the writer undertook the report on his home region, the Catskill quadrangle, it was with the request and understanding that the mapping of the east side of the river would be executed by Dr Rudolf Ruedemann, master of the Ordovician and Cambrian rocks there displayed. Doctor Ruedemann's consent to do this was the more appreciated because of the burden of his engagements already made, which indeed prevented its accomplishment for several years. Meantime there was promise of a topographic resurvey of the quadrangle, the map of which was finally issued from Washington in September, 1938, and the project was therefore held over until this new base became available.

Early we sought also the cooperation of John H. Cook on the glacial geology, to which he has brought a stimulating newness of interpretation. Since the exigencies of the work gave Mr Cook less opportunity to examine the glacial features of the west side, these have been touched upon by me for the sake of completeness, in doing which I have had to present and occasionally to defend the ideas of the old school.

It seemed best, furthermore, to extend the scope of the report to the mountain rocks and region by including in it the Kaaterskill quadrangle next west, and this work I undertook in 1933. In all of this I have had, and desire gratefully to acknowledge, the constant interest, assistance and advice of the State Museum staff, particularly of Doctors Ruedemann and Winifred Goldring but also in the matter of photographs that of W. J. Schoonmaker and the late E. J. Stein. Many others have generously contributed to the illustrations, acknowledgments to whom will be found on the plates. Equally cordial has been the attitude of the property owners on whose lands the field work has taken me, a list too long to itemize. To my wife's active aid during her lifetime I am heavily indebted.

To all of us collaborators the region, old and much visited as it is, has furnished surprises in the way of fresh discovery. Especially has this been true in Doctor Ruedemann's territory. Without his participation the report would in any case have been lame indeed concerning these older rocks. His astonishing finds speak for themselves.

The new base map of the Catskill quadrangle presented such a totally different picture of our topography from the old one of some 30 years ago and depicted its features in such beauty of detail that it became necessary to review in the field practically all of the Silurian and Devonian area. The geological map now presented is the work of 1938, not of 1926, executed with as minute accuracy as the scale would permit and the engraver could compass. The report on these rocks has likewise been wholly rewritten, in much greater detail and enlarged in accordance with the enlarging knowledge of these strata that has come so fast in the intervening 12 years through our own work and that of Dr G. Arthur Cooper and Russell M. Logie in particular, as well as of many others. To these gentlemen also I make cordial acknowledgment of aid and companionship.

There is a further debt to those who have gone before and opened the wonders of this region to our eyes, and whose names live in the bibliographies. Without meaning invidious distinction in a list so long, there yet come to mind the names of grand old Amos Eaton (of Catskill and Troy), of Professors Shaler and Davis, and of Mr Darton. No less is my personal debt for early and continued encouragement to Dr John M. Clarke, Dr H. L. Fairchild, Dr John C. Smock and Henry Brace (of Catskill), and to my enthusiastic boyhood friends, Robert Weeks Jones and Egbert Roy Beardsley.

No one using this book should think of it as a subject now finished and closed. What has been learned is but a stepping stone to further, larger understanding. Many unsolved problems are mentioned in the text in hope that new minds will attack them. The map of the Kaaterskill quadrangle is distinctly a preliminary one, for it was inexpedient at this time to devote to that area the funds for its minute elucidation and its correlation far afield. To the user of the book we wish pleasure as great as ours in the unparalleled geology this region contains.

THE PHYSIOGRAPHIC BELTS

The key to the geology of the west bank of the Hudson in the Saugerties-Catskill region is found in the belted hills (see Davis, 1882, 1883) that traverse it. These hill ranges trend in general parallel to the course of the river and also to that of the mural front

Figure 1 Austin's glen of the Cats kill, Jefferson Heights, Catskill. Mouth of main gorge seen from Eagle cliff (figure 16). "A": locality of figures 58, 12, 13. "B": locality of figure 25. "C": locality of figure 23. "D": locality (concealed) of figure 26. Syncline on left, up to Becraft limestone; anticline right, capped by Manlius. Note old railway grade. Looking north. Photo: March 1928, G. H. C.

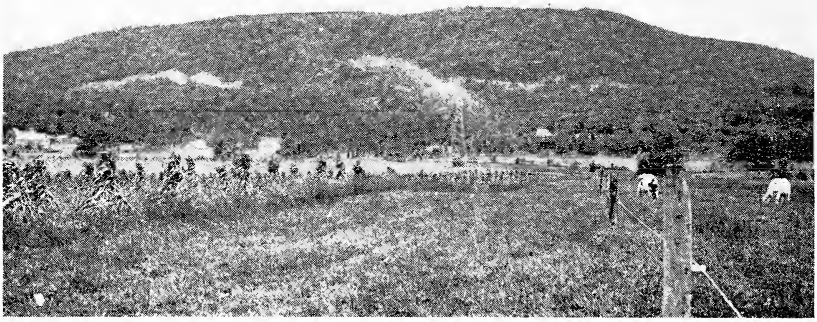

Figure 2 Mt Marion, highest peak of the Hooge berg, from the east, looking west across Albany clays of the Beaver Kill valley. Whole hill is in west-dipping Mount Marion beds. Starfish locality lies on crest above steeper decline to left (south). Photo: September 1936, G. H. C.

Figure 3 Hooge Berg range (two peaks of Vedder's hill, and Mt Potick) of visibly west-dipping Mount Marion beds, as seen from Rip Van Winkle trail west of Webber bridge. Looking east of north, down the Bakoven (Kaaters Kill) valley. Albany clay knolls and creek floodplain in foreground. (See figures 73, 74). Photo: April 1938, W. J. Schoonmaker.

of the Catskill mountains which Longstreth calls the "Wall of Manitou." By the old Dutch settlers the ranges were given names that still linger (see Beers, 1884). The first continuous range west of the Hudson was to them the Kalk berg (pronounced colla-barrakh) or lime hill (figures 1, 39), sometimes corrupted into "Collarback." The still larger or second range west of the long valley of the Beaver kill and Kaaters kill, they called the Hooge berg (hohga-barrakh) or high hill (figure 3), including Mt Marion, Mt Airy, Timmerman's and Vedder's hills. Lastly, the mountains were called the Kats berg (cots-barrakh) or wildcat hill.[1] These three "bergs" are in reality three escarpments, facing eastward, respectively Lower, Middle and Upper Devonian. The thin Silurian beds occupy the base of the most easterly, or Kalkberg scarp.

A space of a mile or two usually intervenes between the river and the Kalk berg. This space is much occupied by the clays and sands of the postglacial or pro-glacial water body familiarly known as Lake Albany (see Woodworth, 1905). But out of it rise here and there minor ridges, especially north of Catskill. None of these ridges on our map-area appears to have received any special designation save only the tiny "lookout" knoll or Kykuit (cake-out) just south of Catskill village (one mile south-southwest of the town bridge) from which the Catskill Indians caught their first glimpse of the sails of the "Half Moon"[2] and our own ancestors watched for the smokestack of the "Clermont." The rocks of this belt are Ordovician (Normanskill shales) described by Doctor Ruedemann.

The Kalk berg, on the other hand, comprises many minor ridges in its breadth of a mile or two, some of which, such as the West berg, the Luyster berg (lie-stair-barrakh) or echo hill, and the Sup berg or sap hill (from its sugar maples) retain their special appellations. The Kalk berg itself appears on our geologic map as the broad band of many colors extending west to the line of the black Bakoven shale and involving two great limestone series separated by the mass of so-called "grits," really impure shales. Where the eastern limestones make their sharp zigzag eastward, south of Cauterskill hamlet, they inclose a V-shaped valley, bounded by impressive cliffs (figure 17), that the Dutch called the Fuyk from its resemblance in shape to a conical fishing-net such as is still called locally a fyke. Here Gates's victorious army encamped on its return from Saratoga. The corresponding valley on the south, north of West Camp, holds the swamp yet known to the elders as the Great Vlaie (fly), *vlaie* meaning a swamp though derived from the word valley.

On the Kalk berg, intermediate between Fuyk and Vlaie, lies a

narrow bit of meadowland similar to the limestone sinks (such as the Alachua prairie) of Florida. Here the drainage from Van Luven's lake and from northward nearly to the Palenville road (highway 23-A) plunges into a crevice in the lime rock to emerge as a "spring" over half a mile south on the main highway (9-W), under the east brow of the hill. The spreading of the waters in flood time has kept this sink area always treeless, and in the older deeds it became a headright for cattle pasturage under the title "een streeke land" (a strip of land), whence it is still known as the Streeke (pronounced stray-kay) and its occasional water body as the Streeke lake.

The double character of the Kalk berg range, divided by the "grits," is best shown south of Saugerties[3] where for four miles the Esopus creek trenches the belt of shale that bears the name of this stream. Both the Kaaters kill and the Cats kill (figure 78) also follow the Esopus shale outcrop but for only short distances.

Behind the Kalk berg, between it and the Hooge berg, lies a longitudinal valley (figure 73), somewhat refilled by the "Lake Albany" clays and by glacial gravels. At the south the Esopus threads this vale as far north as the West Shore bridge. Farther on, the Beaver kill occupies it (figure 2), to its mouth, and then the Kaaters kill for nearly six miles, beyond which a small tributary is engaged in reexcavating it almost to our north limit. This valley owes its existence to the uptilted edge of the soft Bakoven ("Marcellus") black shale (figure 40). It is called the Bakoven valley from the rounded form of the scalloped clay-remnants left in it at various points and especially near the Palenville road (highway 23-A), suggestive to the Dutch of their bak-oven (bahk-ohfen) or bake ovens (figure 74). During the Revolution this valley was the scene of fierce and sanguinary raids on the part of Brandt and his savages.

The Hooge berg, next west, is the range of Mt Marion (figure 2), Mt Airy, Timmerman's and Vedder's hills (figure 3). Twice as high as the Kalk berg, it presents a long row of steep eastern fronts with gentle back slopes into the broad Kiskatom flats. The straight alignment of the peaks veers more to eastward through an angle of 10 degrees opposite Katsbaan,[4] and of course the Kalk berg bends with it; but the broken character of the latter range obscures the point of deflection. Perhaps the best index of this bend, in the Kalk berg, is the change in the course of the Old King's road[5] at Katsbaan four corners.

The width of country here assigned to the Hooge berg in Greene county (Catskill quadrangle) is from two to three miles, though its

Figure 4 Southern end of the Catskill front from Becraft limestone ledge (380 feet) at peneplain level on east ridge of Kalk berg between routes 9-W and 23-A two miles southwest by west from Uncle Sam bridge, Catskill. Late snowfall reveals gentle northwest dip of ledges in the mountain front. The sleeping "Old Man of the Mountains" consists of Overlook (knees) at left, Plattekill (body) and Indian Head. Profile of the last is outcrop of Stony Clove sandstones that also cap two "sawtooth" summits (High peak and Roundtop) to right, seen better in figure 5. A south-moving continental ice-sheet assisted in shaping all these. Monadnocks (Timmerman's hill and knob at High Falls), on the Hooge berg, surmount the peneplain. Looking southwest by west. Photo: April 1938, W. J. Schoonmaker.

Figure 5 "Wall of Manitou" from High peak to North mountain and Stoppel point, continuing figure 4 to north. Note a minor sag crossing all the ridges to west, to South mountain, through which runs the Rip Van Winkle trail. Looking south of west. Photo: April 1938, W. J. Schoonmaker.

Figure 6 Northern end of the Catskill front, completing the panorama of figures 4, 5, with outlying Cairo Roundtop (see figure 77) at right. Blackhead, in middle, is highest peak (3937 feet) visible from Catskill. North mountain (and Stoppel point) to left, Windham High peak to right. Foreground is finely developed Hudson Valley peneplain on summit of Kalk Berg and Hooge Berg hill-ranges. Looking west-northwest from same ledge as preceding. Photo: April 1938, W. J. Schoonmaker.

back line may be a debatable subject. Compared with the greatly folded and thrusted beds of the Kalk berg, the structure of this range is simple. All the strata have westward dip, which finds expression in the unequal opposite slopes of the hills and in the many east-facing minor ledges that give variety to its surface. It is, in short, a zone or belt of westwardly tilted rock terraces. The drainage is thus thrown against the faces of the ledges and constantly freshens them by undercutting.

Behind the Hooge berg, on the Catskill quadrangle, is a broad alluvial plain, the Kiskatom flats (figure 77), a name abbreviated from the Kiskatominakaukee, place of thin-shelled (i. e., shagbark) hickory nuts, of the aborigines. This plain represents a filling up of the glacial lake (Lake Kiskatom[6]) that had its outlet southward through the High Falls[7] pass (figure 44) of the Kaaters kill across the Hooge berg, plus the grade plain of that creek up to Saxton.

With the termination of these flats, on crossing into Ulster county east of Saxton the western limit of the Hooge berg shifts eastward to the two arms of the Miner kill, narrowing this range to about a mile width past Quarryville and Unionville, widening some thence to Fish creek as it reaches its culmination in Mt Marion but dropping almost into insignificance for a short distance southward from the Platte kill past Ruby. This broad gap in the range, like that where the Cats kill crosses it, just north of our area, may mark the course of ancient drainage.

West of the Hoogeberg in Ulster county, or of the Kiskatom flats in Greene county, begin the lower terraces, or piedmont, of the Catskill plateau, their width the counter of that of the Hooge berg since from Overlook mountain northward there is a nearly constant distance of four miles from the east base of the Hooge berg to the foot of the real mountain slope of the Kats berg or Catskill mountains proper. South of Overlook, however, the piedmont belt swings widely west, past Woodstock, Baehrsville and Yankeetown, while out of it rises the short recurved Catskill range of the Tys ten Eyck and Taantje mountains.[8] Less markedly, at the north edge of our area, the piedmont pushes northwesterly through the Kiskatom Brook gap behind the outlying knob of Cairo Roundtop.

This piedmont area has even more massive cliffs than those in the Hooge berg, but with much less west dip. The effect of master jointing is conspicuous in the cliffs, giving their eastern fronts great directness and parallelism, as is well shown by the straight course of the 400-foot contour line both north and south of Stony brook, and of the 500-foot contour northwardly from Palenville for two miles.[9]

Passing now from the Hudson valley up into the mountains, we find there a very different geography. The mural front or Wall of Manitou (figure 5) alone parallels the hill ranges of the valley. Instead, the mountain ranges run directly away from this front. Starting at Overlook and Plattekill mountains the great central range (figure 54) goes northwesterly, increasing steadily in height and massiveness to Hunter mountain (figure 55), its highest peak, 4,025 feet, beyond which (off our area) it gradually declines. The eastern or front range, starting with South or Kaaterskill mountain, likewise runs northwest, through North mountain and Stoppel point (figure 5), but reaches its culmination off our map (in Black Dome, 4,004 feet; see figure 10). Between these lie, first, the East Jewett spur range from Stoppel point west and, second, the short independent range of High peak and Roundtop[10] (figure 52), embraced between the two cloves. Spur ranges also fray out westward from the central range, especially the Olde berg south from Plateau mountain and the range from Overlook past Shady that suddenly swells up into Mt Tobias. The wholly disconnected range of Tys ten Eyck on the south, and its small companion, Cairo Roundtop (figure 77), on the north, have already been mentioned.

The explanation of this difference is in the rocks. In place of the upturned, folded and belted rocks of the valley, the mountains and their supporting plateau consist of nearly horizontal strata (figures 47-52) which have exerted no control over the courses of the streams. In these flat-lying beds the mountains are negative features, namely, what has remained after the valleys have been carved. Nevertheless, in this process of valley-carving, a slight southwesterly slope of the strata has edged the main streams over against the northeast fronts of the ranges, as is well shown by the Schoharie creek hugging the central range, and has favored the development of tributaries, hence of spurs, on the opposite side. Thus the central range (figure 54) is really a fourth escarpment (see page 11) to add to our list, though its direction is skewed from that of the others.

Not only these larger, but many minor features of the geography, will find their explanation in a study of the geologic mapping. But it may be noted in passing, for explanation later, that while the mountain ranges do not parallel the valley hills, nevertheless the valleys that cross these ranges do strikingly so parallel the hill ranges, the river and the Wall of Manitou, a fact illustrated best by Stony clove and Mink hollow (figures 76, 71; see Chadwick, 1916).

The drainage courses of our region tell also a geologic story. On the mountains, while the drainage pattern is dendritic (branching

treelike), yet the flow is in general away from the Hudson valley instead of towards it and nearly all the stream-heads on the eastern edge of the plateau start off westerly, though some of them get turned back eastward after a bit through capture by Hudson tributaries, as described in a later chapter. There is in this westward flow convincing evidence that the Hudson valley is a late development in the erosional history of the region, and that the earlier drainage ran off from high ground where now is the Hudson river, to hurry westward towards the Mississippi if not to it (Ruedemann, 1932; Fairchild, 1925, 1928).

All the waters of our area eventually reach the Hudson, however, those of the southwest by the shorter route of the Esopus creek, those of the northwest by the 150-mile circuit of the Schoharie kill and Mohawk river (see Guyot, 1880). But this is not true of the western Catskills, which drain to the Delaware and the Susquehanna rivers.

The land is shaped by the streams, sometimes unhindered, but sometimes the land in turn shapes the streams, as is particularly evident in the adjustments that the creeks have made to the parallel belts of soft and hard rocks in the Hudson valley. Yet, unexpectedly, most of the mountain tributaries maintain this parallelism, as above noted, flowing not directly but slantingly down the slopes of the ranges. Evidently here, in these flat-lying rocks, there are still vertical zones of weakness that impress the brooks into their pattern and, since these conform in direction to the master joints of the piedmont terraces, it seems reasonable that they also are joints, closely spaced at rather regular intervals of about a mile. Such zones also invite faulting, especially the internal settling known as "keystone" faulting (Crosby, 1925),[11] but as yet actual faulting has been demonstrated in only the easternmost of these lines, namely that which is tangent to the east end of North lake.

Stream courses out of tune with the stratigraphy in the valley are chiefly the effects of glaciation. These include the tortuous postglacial gorge of the Cats kill in Austin's glen (figures 1, 78), and also the diagonal courses of both the Kaaters kill and Platte kill (figure 42) through the Hooge berg. There are similar courses of two small brooks farther north, on Vedder's hill, and there is the remarkable unexplained pass running northeast from High Falls. The Kaaterskill and Plattekill cloves are noted examples of "stream capture" (Darton, 1896; Salisbury & Atwood, 1908)[12] to be discussed in a later chapter and to these should be added the notch of the Saw kill at Shady.

Glaciation is responsible likewise for some of the peculiarities of the Hudson river, particularly for its curious expansion above Alsen called by the Dutch the Grote imbogt (or Imbocht), great embayment or bight, (of which the modern pronunciation is imbuff). It must be remembered that the Hudson is a drowned river, a tidal estuary, spilling up over its former banks, as it does markedly at Cruger's island below Saugerties, on the east side. The narrowing of the river below the mouth of the Cats kill and again at that of the Esopus at Saugerties is in each case due to recent delta building of these creeks. But Rogers island is a south outpost of an upsilting that extends all the way down from Troy and Albany—the "inner delta" of the Hudson itself.

Supplementary Notes

[1] Kill is Dutch for creek. The Cats kill is the stream, and to follow this name with the word "creek" is tautology, as it is also in the case of the Kaaters (pronounced, and sometimes spelled, cauters), the Platte (plahtay), the Beaver, Hans Vosen or other kills of this region. (See N. Y. State Mus. Bul. 92, p. 86, footnote.) The English unfortunately shifted the creek name to the mountains, which the aborigines had called Onteora (correctly On-ti-o-ra) or hills of the sky.

[2] Henry Hudson, often miscalled Hendrick (he was an Englishman in Dutch employ), sailed up the river in the autumn of 1609 on his voyage of discovery. In 1809, Robert Fulton brought the first steamboat up the Hudson. A joint celebration and pageant of these events was held in 1909 in the river towns.

[3] Saugerties, zaagertjēs (as the older inhabitants still pronounce it, and correctly) means the little sawyer's place, but the name of this dweller on the Saw kill or Sauger's kill has been long forgotten.

[4] Katsbaan (kahts-bawn), cats' haunts, because the pumas had a den under the low ledge, has one of the oldest churches of the region, with long records.

[5] The Old King's road or royal post road of 1703 followed an ancient trail that remained only a footpath until 1670. Its original course through the Fuyk, trod by Gates's army, was abandoned after the Revolution and the road relocated to follow the creeks. It was not only the first highway in this region but in 1830 it was the first "state road," as distinct from the turnpikes. Many old buildings line its route.

[6] Like most aboriginal names, Kiskatom is accented equally on all syllables—a safe rule generally. (For Lake Kiskatom see Chadwick, 1910*a*.)

[7] Known to the postal authorities as Great Falls, to distinguish from the post office of High Falls in Ulster county (Rosendale quadrangle).

[8] These names appear on maps in much corrupted forms, such as Ticetonyk and Tonshi. 'Tys is a Dutch abbreviation for Mattys (Matthew or Matthias), while Taantje means auntie and on the oldest maps we find it as Taantje Hoek, auntie's corners, at a road intersection. This last name and Ohayo ("Ohio") mountain have been much shifted around on the maps or interchanged. Ohayo is said to be correctly "Heigho-heigho," but I can not vouch for this origin.

[9] This parallelism of the contours has three significant interruptions: past Palenville, past West Saugerties and from Woodstock to Baehrsville. The "bulging" of the contours at these points signifies the great alluvial fans of cobbles and gravel and sand built respectively in front of the Kaaterskill clove, the Plattekill clove and the notch of the Saw kill in post-glacial time, these being the three main streams that come steeply down out of the plateau.

[10] Namely, Kaaterskill (or Palenville) High Peak, and Kaaterskill Roundtop (or Mt Lincoln), for distinction from other High peaks and Roundtops.

[11] In Mather's cross section of the Stony clove (see W. W. Mather 1843: plate 25, figure 8), he shows a discordance of the beds on the opposite sides which suggests faulting. Attempts to check this in the field have been defeated by weather conditions.

[12] Clove is a Dutch term for these great clefts in the mountain, of which three principal ones appear in our area (Kaaterskill, Plattekill and Stony) besides the Rip Van Winkle (Sleepy Hollow of map) and Winter cloves. Platte (plahtay) kill or the flat (level) creek, is often misspelled "Plaater" or "Plaaters" by analogy with Kaaters, and this error is found in the postoffice name of the hamlet ("Plaat Clove") at its upper end. The locally erected signs read correctly: Platte Clove. "Platter" kill is another misspelling. (See Beers' History of Greene County 1884, p. 109.)

HISTORICAL ACCOUNT

Geological observations in the Catskills began, so far as found, with Dr Samuel Latham Mitchill (1764-1831), of Columbia University, before the opening of the nineteenth century and with William Maclure (1763-1840) of Philadelphia at about the turn of the century.

Mitchill's papers on our region were published in ephemeral ways or in medical journals and are known to me only through Mease (1807). He described as schist the compressed Ordovician rocks of Dutchess and Columbia counties, stating that it served "as a bed to the calcareous strata scattered throughout the country, and [he] mentions a block of this kind a mile from Claverack and four miles from the city of Hudson on the river of the same name, presenting a prominent mass eight hundred acres in superficies, filled with shells, none resembling which are to be found in the nearest sea, distant a hundred and forty miles!" (Mease 1807, p. 39; see also p. 42, 50, 403, 406.) This is Becraft's mountain.

Mitchill imagined (Mease 1807, p. 39-40) concerning Kingsbridge and Harlem

that at a period unknown in history the ocean covered this ground and his opinion is supported by all the facts he mentions respecting the Kaats Kill mountains.

These mountains he has found to consist of the same sandstone as Blue Ridge, of which he deems them a continuation. He first imagined these mountains to be of primitive formation, because the granites and sandstones contained no fossils; but he soon found contrary indications: as, 1st, the aspect of rocks containing pebbles or small stones of red and white quartz, sandstone and red jasper, all evidently rolled and worn by the waters; 2dly, horizontal and very [page 40] regular strata of these rocks; 3dly, fossil shells unknown in these seas, the clam and scallop excepted, and found on their summits in an argillaceous or in a siliceous bed.

In such quotations we see accuracy of observation struggling through the primitive state of geological science less than a century and a half ago, when Catskill with a population of only 1,000 was

twice as large as Buffalo, and larger than Erie and Cleveland combined (see Melish 1818, p. 78, 87, 107).

Mease (1807, p. 8, 19, 22-24, 37, 40, 404) says that sandstone proceeds "up the western bank of Hudson's river to the group of the Kaats Kill mountains," the "highest peak" of which (then believed to be High Peak west of Palenville) was "measured in 1798 by Peter de la Bigarre" and found to be "3549 feet above the level of Hudson's river," which approximates the present accepted elevation of 3660 feet though this is far from being the highest peak. He thinks that all three of the Appalachian ranges (Blue Ridge, Kittatinny and Alleghany) lose themselves eventually in our mountains or their Delaware county extension (which is a mistake), says that roofing slate "(schistus tegularis)" "is now extensively worked" in the township of Rhinebeck and that Hudson's river below Albany to present Beacon "flows between two rugged declivities, covered with thin copses of oaks and firs" (a good description of the "inner gorge") and refers again to "the sandstone of Kaats kill" as characterizing the region from the Hudson and Mohawk as far as Georgia and west to Tioga, Pa. This is early recognition of the great red-beds delta deposit later passing current as the "Catskill formation" (see Chadwick 1936).

Mease gives (1807, p. 455-58) an unequalled word-picture of our two noted waterfalls, apparently taken from Doctor Mitchill (whom he always spells Mitchell), calling the creek "Kadir's kill" and "Kader's kill" and the Kaaterskill falls also "Mitchell's falls" possibly in honor of Doctor Mitchill. The latter he says are 162 plus 80 feet high, total 242 feet, while the other (Haines's) falls he makes 115 feet, with the small fall at top and the lower fall and cascades adding to 400 feet drop in a quarter of a mile. He alludes (page 59) to the clayslide at West Catskill occurring on June 1, 1796, (see the account by the Duke de la Rochefoucault Liancourt in 1799 quoted by Beers 1884, p. 124), as follows: "Instances of the effect of streams and rivers, in altering the disposition of the solid materials through which they run, occur . . . at Kaat's kill, where part of a hill has fallen down; . . ."

Maclure's work was part of a countrywide survey, the map of which appearing in 1809 (and 1817) is on too small a scale to give local detail, nor is such included in his text. The portion of the Catskill quadrangle between the Hudson and the Jansen kill is colored as "transition rocks" (which include limestone, graywacke and flinty slate in his tables), while the Silurian and Devonian area west of the Hudson is mapped as "floetz or secondary rocks" (which include

old red sandstone and floetz-limestone) thus making them of Mesozoic age in modern parlance.

The cataclysmic philosophy of early earth-science is illustrated in the next accounts of our region, by Dr Samuel Akerly (1785-1845) in 1814 and 1820, who, after describing "the whole country north of the highlands as underlaid with primitive slate, most of the hills being composed of limestone" (Merrill 1906, p. 223), as they are around Poughkeepsie, explained his ideas thus: "The highlands of New York was the southern boundary of a huge collection of water, which was confined on the west by the Shawangunk and Katts-kill mountains. The hills on the east of the Hudson confined it there. When the hills were cleft and the mountains torn asunder, the water found vent and overflowed to the south. It was then that the channel of the Hudson was formed, and its stream has never since ceased to flow." Similar theories were held by Mitchill (Merrill 1906, p. 231) and others in those days.

The lengthy "account of the Kaatskill Mountains" given in 1820 by Henry Edwin Dwight of New Haven comes next, and was his sole geological publication. After extolling the scenery, referring to his description of our two cataracts (pages 17 and 21), he says (page 12): "The cascades which I have described, I visited immediately after the heaviest fall of rain that had occurred within the memory of the oldest inhabitant." (This was the storm of July 26, 1819, reported by Mather 1843, p. 42-43, and described by Benjamin W. Dwight in Silliman's Journal, v. 4, p. 124-42.)

"Some idea can be formed of the quantity of water that fell, when it is known that one mile north of the village of Kaatskill, a ravine was formed by the water directly through a wood, one hundred and ninety feet in breadth, by seventy-nine in depth, for the distance of nearly a furlong; when it united its waters with the Kaatskill creek." This I suppose to be the gully entering the Hans Vosen kill from the west where that is crossed by route 9-W and causing also a twist in route 23 on the plain above.

Dwight (1820, p. 12) followed Maclure and Eaton (see page 28, *postea*) in calling our mountain rocks "secondary" (that is, Mesozoic) but says that those of the river shore are "Wacke." Under the head of "Petrifactions" he says (page 13): "On the Kaatskill creek three miles above the town, is a cascade of about 20 feet in height." (See our figure 23.) "South of this fall, the rocks which form the bed of the stream, run parallel with the current and are composed of carbonate of lime. They are partially composed of petrifactions of the clam, entrocite &c. The entrocites vary in length from one

to six inches, though they sometimes exceed this. I saw imbedded in one of the rocks, one fifteen inches in length. They lie on the surface and in oblique and right angled position." (Are silicious in the limestone.) "The entrocites commonly appear straight and resemble vertebrae united to each other. Sometimes they assume a twisted appearance, as if struggling to escape when first imbedded. I observed here several pieces of Madrepore adhering to the rock or imbedded in it, weighing from ten to twenty pounds." (Notes flint veins with quartz coatings.) "The rocks forming the bed of the stream appear to have been rent asunder, leaving cavities of several feet in breadth and ten in depth, in which, when the stream is very low, most of the water runs."

He next gives a good description (pages 13-14) of Diamond hill, the little knoll of Normanskill rocks opposite the Hoponose (figure 62) that furnished quartz crystals until destroyed about 1890, and discusses the crystals from here with fluid cavities containing what Professor Dewey (1819, p. 345) had supposed to be naphtha but which Dwight takes to be water since a friend's specimen froze and burst at —6 or 8° F. and the fluid evaporated.

Between the village and the mountain, [he says (page 15)] the country is altered in its appearance. Near the western end of the bridge, which crosses the Kaatskill at the village, a hill rises to the height of 150 feet. The rocks which compose this hill are much more compact than those near the river. They have a dark blue colour and bear a much stronger resemblance to trap. Half a mile west of this, a ridge of land rises to the height of fifty feet, when the country changes to carbonate of lime. These rocks are compact and filled with petrifactions of the clam, entrocite &c., often in so great quantities as to compose one sixth of the rock. [See our figures 19, 27.]

Two miles from the base of the mountain, the Limestone region terminates. Sand stone immediately appears. The earth here assumes a more reddish appearance and continues of this colour to the mountain. The sand stone terminates at the base of the mountain. As you ascend the mountain, slate begins to appear resting upon the sand stone below, varying its strata from nearly horizontal to an angle of 30° [page 16]. [Slate for a third of the ascent, then sand stone again.] On the peaks of these mountains, are many specimens of conglomerate or puddingstone. I observed a rock of this kind (on the peak north of Round Top,) of half a mile in length and from eight to ten feet in height, forming an immense band to the mountain, . . . [No limestone found on the mountains.]

On the same page he speaks of "the clove or cleft in the mountain, which appears to have been formed by some great convulsion of nature" (figure 7). Then follow (pages 16-23) paragraphs on the

Figure 7 Looking down the Kaaterskill clove east-southeast from bridge on brink of Haines' falls, Catskill mountains, to the distant mist-concealed Hudson valley. A bit of the Rip Van Winkle trail visible in center. Dark foreground is short postglacial gorge, with top ledges seen at left and lower right. Note contrast in slopes between the inner valley, of later development, and the matured upland surface on left (South mountain). One of the two great ravines opened back into the "Wall of Manitou" since the erosion of the Hudson valley to its peneplain level (figures 4-6). Photo: April 1938, W. J. Schoonmaker.

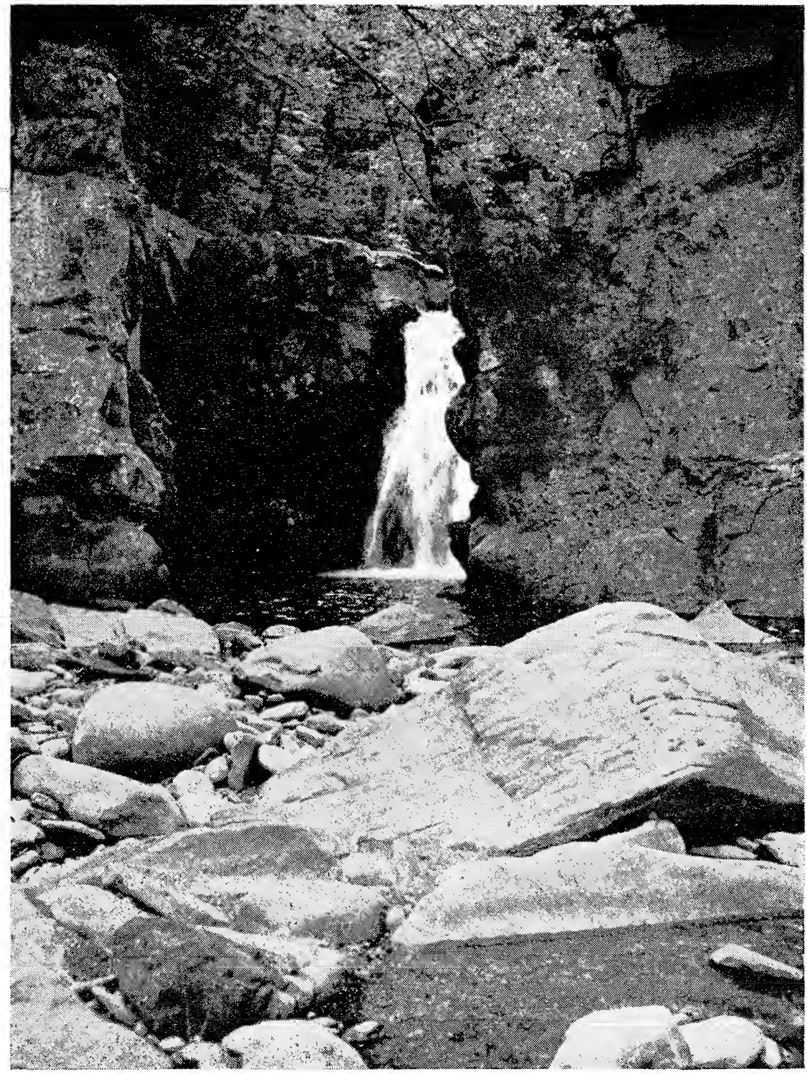

Figure 8 Kiskatom sandstones (Portland Point horizon?), the Kaaters kill at Fawn's leap (falls) in Kaaterskill clove on Rip Van Winkle trail about one and three-quarters miles above Palenville, a few rods above figure 9. Stream abrasion of transported rocks and boulders, giving rounded and sandpapered effects. Note "sandpapering" also of both bases of portal and on brink of fall. Looking west. Photo: May 1938, W. Storrs Cole.

Figure 9 Ice hangings, plucking at Church's ledge above Moore's (Moe's) bridge on Rip Van Winkle trail in the Kaaterskill clove, about one and one-half miles west of Palenville and not far below Fawn's leap (figure 8). Heavy Kiskatom sandstones topping red shales give special susceptibility to ice pull. Looking south of west, upstream, from bridge. Photo: E. J. Stein.

Figure 10 More subdued older upland surface to north of the Kaaterskill clove (compare deep ravine of figures 50, 7) looking from roof of Hotel Kaaterskill (since burned), two miles east of Haines' Falls, N. Y., north-northwest past Stoppel point (right) to the distant Blackhead range (Thomas Cole and Black Dome mountains visible) on the Durham quadrangle, across the upper end of the north fork of the Schoharie Kill valley now captured by the Kaaters kill at Kaaterskill falls (figure 48) left of view. Photo: April 1923, C. A. Morrison.

Kaaterskill clove, its two waterfalls, the Stony clove, the altitude of the peaks (of which he takes Round Top at 3800 feet to be highest, meaning probably present High peak), the mountain lakes (said to be over a hundred feet deep in the center!), and other topics. After discussing the vegetation, he comes back (page 26) to the streams and says of the "Schohariekill" (on page 27): "Hence the waters of this stream, which originate within three or four miles of the Kaatskill, run about one hundred and fifty miles before they unite with them in the Hudson."

In 1821 appeared brief papers by Benjamin Wright and by John P. Jenkins (for titles, see the bibliography chapter), and in 1822 one by David Walker Barton "of Virginia," giving mineral occurrences and a map which divides the space between the foot of the mountains and the Hudson into fourteen parallel belts trending about 30° east of north, (described, pages 250-51). He says (page 249): "1st, on the side of the mountain which rises immediately to the north of Kaaterskill clove and about a quarter of a mile from the dwelling of Mr Absalom Smith, is a ledge of common argillaceous slate, from which during the winter and spring, issues a small stream, strongly impregnated with alum." (Deposits it in the form of a powder.) [Page 250] "It is here collected in considerable quantities and employed without farther preparation as a substitute for the imported alum." His "2d" is malachite, quartz and baryte in sandstone two miles east of the mountains and his "3d" is "Fer Ologiste" or specular iron which he says is frequent in detached quartz (glacial drift?). "4th, in the channel of a stream, two miles south-east of the Durhan meeting-house, (Greene county,) I found the sulphat of iron" associated with plant fossils, etc. Until 1851, Durham meeting-house with the crumbling village of 1784 stood on the now vacant hill a mile southeast of present Durham, and the stream referred to is probably Post's creek at the spot where stood Roswell Post's grist mill, now known as Shady Glen (see Beers 1884, p. 259), and where the name Catskill was first attached to the red-beds (Mather 1841, p. 81; see Chadwick 1936, p. 27).

In 1823, Dr James Ellsworth Dekay described under the name Bilobites what he correctly recognized as a double specimen of a bivalve shell (Conocardium; see *postea,* page 35) from our marine Devonian strata, but which was later confused with forms of "plant" origin (burrows) and solemnly still so listed in 1889 by Ward (1889, p. 854-55), collected at Cairo by James Pierce (of Catskill). The latter, in the same year, produced a rather lengthy paper on our mountains, covering their "topography, scenery, mineralogy, zoology,

economical resources &c." in which the chief item of interest now is the report (pages 95-96) of a coal bed eight inches thick on the east face of the mountain (Overlook) in Woodstock.

Meanwhile there had come to our midst a struggling and always unsuccessful young lawyer, almost fresh from his graduation at Williams College in 1799, but destined to become the father of American botany and the pathbreaker for the great geological survey of New York. This man was Amos Eaton (1776-1842), until his death senior professor of sciences at Rensselaer Polytechnic Institute, Troy. He was admitted to the bar in Catskill in May 1804, his sons born here between that year and 1809, and his household as shown by the 1810 census, including his parents, totalled nine persons (Beers 1884, p. 33, 41). He was in such straits, according to Stuart Gager, that his popular manual of botany came to birth in a debtors' prison. In Catskill, his love for science developed; I believe he founded a local "lyceum" or natural history society (see Silliman's Journal, v. 3, p. 237) that continued to flourish after his departure (*vide postea,* page 30). For in 1816, at the age of forty, discouraged, his father and mother dead, he gave up law and went to study under Professor Silliman at Yale and began his marvelous career by tramping all over New England and New York giving short lectures and arousing such enthusiasm that he was drawn back to his alma mater, then to more profitable and permanent positions and, becoming the favorite of Stephen van Rensselaer, in 1824 to Troy. In that year was published his first short paper of local interest, having to do with the introduction in England of the new name "Carboniferous" including at base the old red sandstone, and the question of its adoption in America. This was followed by many others (see bibliography).

But already in 1818, while still lecturing at Williams College, he had put out his first 52-page book, known as the "Index," which in 1820 went to a second edition with 286 pages. Opposite page 6 of the first edition is a "geological traverse from Catskill mountain to the Atlantic," on which appear in order the names "Catskill Mt., Eaton's mill, Kiskatom, Cautrix kill, Catskill, Hudson river." I have not learned where Eaton's mill was situated. He classified our rocks (pages 25-33) as "8. Metalliferous limestone. 9. Argillaceous & Siliceous slate. 10. Graywacke slate. 11. Rubblestone."—these being included in the "transition" rocks, and "12. Red sandstone. 13. Breccia. 14. Compact limestone."—these being called "secondary" as by his predecessors. One does not get the idea that he saw as yet clearly the true stratigraphic succession of our formations. In the second edition he shifted the old red sandstone down into the transition

rocks, but left the breccia and the compact limestone in the secondary. (See his pages 187, 190-91, 193-94, 207-9, 216-18, 225.)

Later in 1824 came from the press his book on the Erie Canal survey. That he was still classifying rocks by their mineral constitution instead of their time order is evident (page 34) in his statement under "13. Graywacke" (page 33): "But it is coloured . . . red with the peroxyd of iron near the foot of Catskill mountain. Localities.— . . . It constitutes most of the Catskill and Allegany mountains." On the same page he defines the "14. Old Red Sandstone." and says:

But it is very abundant near the top of Catskill mountain, about forty miles south of Schenectady. It contains petrifactions of branching corallines, resembling the roots of woody plants. These petrifactions, being mistaken for dry land plants, have caused this rock to be placed in the secondary class. I have traced a single branch of this petrification more than thirty feet in this rock. [Page 35] One mile south of Pine Orchard, on Catskill mountain, this petrifaction is very abundant in this rock.

Pine orchard is the site of the Mountain House, and the old flag quarries a mile south are good collecting grounds for fossil tree-ferns. On page 92 he again says of the old red sandstone: "It is in layers alternating with the highest layers of graywacke, towards the top of Catskill mountains, and of its subsiding ridges." And on page 93 he once more mentions "the old red sandstone of the Catskill mountains," foreshadowing the adoption of the name Catskill for these red-beds.

Yet to the (page 37) "22. Cornitiferous Limerock" of the valley (our Onondaga) he gives a higher position and says of it (page 38): "It seems to be the most extensively continuous shell-limerock in our district." On page 136 he calls it "(or Second Shell Limerock.)" There are other mentions of the Catskill mountains (pages 89, 151, 152) and Greene county (page 90), especially (page 44): "Whereas the Catskill mountains and their subsiding ridges, which manifestly appertain to the Green Mountain range, are very barren in useful minerals." And (page 45): "I venture to add that the Catskill Mountain graywacke does not cross the Mohawk any where west of Schoharie Kill." (This is perilously like a formation name.)

Adverting further to the age of the graywacke and its associated rocks, and having in mind Diamond hill, he says (page 84): "Do not the limerocks about Hudson and Catskill belong to the transition class, overlay transition sandstone and pass under the Catskill Mountain graywacke? Is not the rock at Catskill, from which so many crystals are taken, transition sandstone? All these localities ought

to be attentively examined by the members of the Hudson and Catskill lyceums." (Page 86): "All the graywacke which lies south of the canal, is connected with the Catskill Mountain range."

(Page 87): "The *rubble* graywacke is very common in the vast graywacke district connected with the Catskill mountains. . . . The *red* wacke forms an extensive layer along the foot of Catskill mountain, west and northwest of the village of Catskill, about forty miles southwesterly from Albany. . . . My opinion has lately been confirmed by Prof. Silliman [page 88] and the president of the Catskill lyceum, who examined it in place. See Silliman's Journal of Science." (This reference seems to be to Pierce 1823; see Silliman's American Journal, v. 5, p. 405.)

"*Grindstone grit* and *hone slate* are very common in the graywacke rocks connected with Catskill Mountains." (The best are said to be at Blenheim, Schoharie county.)

Field classes in geology began with Eaton in 1817 at Williams, and Catskill became one of their objectives. We find his recording (1830*a*, p. 153-54) that he and his students "spent Sunday in Catskill" on June 27, 1830, but that was only one out of many such visits. There is direct mention of our region in every one of his writings that is listed in the bibliography.

Eaton lived to cooperate with (see Eaton 1839) and rejoice over the completed labors of the great natural history survey of New York that he did so much to have established, but not to enjoy the bulky volumes of the final reports. The work that he began of untangling the rocks of our Catskill mountains is now being furthered by the writer, just one hundred years his junior.

Before the state survey was organized, Dr James Eights (1798-1882) of Albany, explorer later of the Antarctic, ran some articles in a short-lived magazine. Accepting the term Carboniferous, inclusive of the old red sandstones, he says (1835, p. 27) of "that magnificent carboniferous group:" "Its eastern origin is along the shores of the Hudson river, from which it stretches out, in a nearly horizontal position, far away into the remote regions of the west, . . . the base of the Rocky mountains." The descent from the Pennsylvania line west of Broome county to the St Lawrence river he describes as "down a series of gigantic steps—first, the great coal measures; next, the carboniferous limestones; then, the old red sandstone; fourth, the graywacke slates, and lastly the transition limestones," showing that he confused the Silurian red rocks with the old red sandstone (see *postea,* page 119).

The most recently indurated rocks of the South of New York [he says] are unquestionably the Coal Measures of foreign geologists. They are of great extent, covering about one-third of the whole State; and passing into Pennsylvania, . . . Their eastern termination is by an irregularly elevated ridge of hills, commencing in the western part of the county of Orange, and extending in a north direction a few miles from the Hudson river, until they reach the county of Albany, including in the range, the whole of what are denominated the Catskill mountains. [This description includes the Hooge berg.]

The greatest elevation of these coal measures [he continues] are the Catskill mountains, whose summits attain the altitude of three thousand eight hundred and four feet, above the tide water of the Hudson river, nearly two thirds of which may with propriety be considered as being occupied by its numerous strata, but in proceeding west, they by no means retain this considerable thickness, for their superior strata appear to have been swept almost entirely away. From this great elevation, in descending along its eastern face, these alterations may be seen projecting one beyond the other, in such a manner as to form a seemingly regular series of steps, plainly exhibiting a southerly inclination, which is distinctly visible, from any elevated situation along the opposite shore of the river, and more particularly so, should their upper surfaces be covered with the snows of winter.

The southerly dip was of course what Eights saw from Albany or Greenbush, and so does not fit the Wall of Manitou.

Mentioning the Blossburg coal field, he thinks (page 28) that no workable coal "can ever be found of the like importance along this northern termination of the coal measures, for I conceive it to be probable, that these beds occupy a situation in the series, much superior to the strata found in our State, with the exception of those at their eastern confines, where the whole series swells out to their entire thickness, and forms the elevated range of the Catskill mountains." (In this, as in the previous paragraph, Eights was of course mistaken as to the horizontality and correlation of the layers.)

Continuing, he says:

From the summit of these mountains, red sandstones may be distinctly seen descending by repeated alternations, each succeeding stratum, becoming gradually thinner and thinner, and finer in its particles, until they terminate nearly midway in the series, and although they very much resemble the old red sandstones of the west, they can readily be distinguished by their organic remains.

This may be a comparison with the Medina sandstone of western New York, which is early Silurian.

In his "notes," Eights (1836, p. 114) describes the "Great Falls" of the Esopus (Glenerie falls) and adds:

It is near this place that the Catskill mountains attain their greatest altitude, being elevated nearly four thousand feet above the tide water of the Hudson river, and the whole mass is unquestionably constituted by the millstone grits and shales of the true coal measures of foreign geologists. The upper stratum, and that which forms the summit of the mountain, is a coarse conglomerate of great thickness, [on "red sand-stone," while lower is "grauwacke slate"].

On page 115 he speaks of the "gritty clay-slate" (our Esopus shale), occurring in the bed of the Esopus and containing "a multitude of cock-tails," which caused Mather (1843, p. 342) and Vanuxem (1842, p. 127) to refer to it as the "cocktail grit of Dr Eights." A woodcut section from the Catskill mountains to the Hudson river at Glasco is given by him (page 116), and later (page 147) he speaks of the plant fossils "so abundantly to be met with in ascending the zigzag road, to the mountain house of Pine Orchard, from below." (See figures 5 and 6 of Chadwick 1936.)

The geological (and natural history) survey of New York was organized in 1836, following a report to the Legislature by John A. Dix, secretary of state, who gave a list of papers published to date in Silliman's Journal (American Journal of Science) on the geology of New York, and Lieut. William Williams Mather (1804-59) of West Point was assigned to cover our district. Other survey members whose names concern us are Lardner Vanuxem and James Hall, the latter entering the ranks in 1837 and becoming the renowned state geologist for a period of over half a century after the close of the survey.

Mather's first annual report (1837, p. 64) mentions only (so far as we are concerned) the occurrence of limestone for lime and hydraulic cement in the "Helderberg and Catskill Mountain ranges." These first reports were reviewed by Professor Chester Dewey (1837). Mather's second report (1838, p. 166) interests us only for his account of Becraft's mountain, Hudson. He speaks of "The lower beds of limestone of Becraft's mountain," meaning the Manlius; "The middle beds of Becraft's mountain," meaning the New Scotland, and says: "The upper beds of limestone in this mountain, are distinctly crystalline," referring to our present Becraft limestone.

From this beginning of real discrimination of geological formations in New York, five years of work by the survey gave us that elaborate succession of rocks in the "New York series" which immediately became the pattern for the rest of the country and which has so marvellously stood the test of time. Upon what slender basis the survey had to build is evident in the quotations above given at some length chiefly because they are comparatively inaccessible today;

but also to emphasize the strides that were made in each successive annual report of these men.

In the third report, Timothy Abbott Conrad (1803-1877), paleontologist of the survey, gave (Conrad 1839, p. 62-63) an inchoative classification of our "transition" (that is, Paleozoic) rocks, the Devonian not having then been distinguished from Silurian and Carboniferous, which may be summarized briefly (see Merrill 1902, table). Below the "10. Carboniferous strata, (in Pennsylvania)," he groups all the rest as "ROCKS OF NEW-YORK" in four divisions: "Old Red Sandstone Group, (Murchison.)" "Medial Silurian strata." "Lower Silurian strata." and "Cambrian System, (Sedgwick.)" These are pretty closely what the survey later called respectively the Erie division, Helderberg and Ontario divisions and Champlain division, with a long belated recognition of the Cambrian. Under the highest, with a subhead *"Old Red Sandstone?"*, he has "9. Olive sandstone, (organic remains undetermined, except a few land plants, very rare,)" which is possibly our Ashokan, and "8. Dark coloured shales" of which the fossils listed are plainly Hamilton forms, and "Black slate" with "Posidonia" which is the Marcellus.

Under the medial Silurian come "7. Gray Brachiopodous sandstone, Helderberg sandstones, Helderberg limestones, Second Pentamerus limestone" tabulated and followed by their diagnostic fossils; these show an inversion of order of the first three, the brachiopodous sandstone being the Oriskany and the Helderberg sandstones the Esopus (and probably our Schoharie), while the Helderberg limestones have a bare sprinkling of Lower Helderberg species in a goodly list of Ulsterian (Upper Helderberg) fossils, chiefly of the present Onondaga limestone. The last member is Lower Helderberg. Then (page 63): "6. Gypseous shales" now Bertie and Camillus, "Rochester shales," with no mention of the Lockport limestones, and "Pentamerus limestone" which is Clinton, together with "5. Green slate, lenticular iron ore, &c." "4. Niagara sandstone, (red)" which is the Medina.

In the lower Silurian: "3. Salmon river sandstone, (olive)" with Lorraine fossils, and "Green slate" with "Agnostis pisiformis" which he wisely qualifies with the statement: "The position of this rock with Agnostus was determined by Mr Vanuxem," for (see change to *A. latus* in Conrad 1840, p. 201) it belongs up in the Clinton group. Then "2. Gray crinoideal limestone" (with the fossils of the next), "Trenton limestone and slate," "Mohawk limestone" now Black River group, "Gray limestone with sparry veins" meaning calcite, now

Lowville, "Gray calcareous sandstone" later the "Calciferous" or Beekmantown in its broad sense.

What interests most is what Conrad at this early day put in the Cambrian, as not adequately shown by Merrill (1902), namely "1. Olive sandstone and slate" with *"Fucoides serra,* (Brong.)," a graptolite of the "Quebec group" and of the Deepkill "Hudson River" beds of New York (Ruedemann 1904, p. 655); "Variegated sandstone, (Potsdam sandstone of Emmons,)" with *"Dictuolites radians"* (unidentified). The inclusion of Hudson River rocks in the Cambrian was no accident. On page 57, after stating that the Cambrian and Silurian systems are unconformable in Europe, Conrad says: "The upper term of the Cambrian system may be recognized in the vertical and contorted slates and olive sandstones of the Hudson river, extending from Newburgh to Glen's Falls." Again: "Over the highly inclined strata of the [page 58] Cambrian or Hudson system, rest in a nearly horizontal position the Silurian strata," and: "In the report of the geologist of Pennsylvania, the olive sandstone of the Cambrian or Hudson strata, has been confounded with the fourth rock of the Silurian system, known by the name of Salmon river sandstone, which formation is admirably characterized in New-York, Pennsylvania and Ohio, by the *Pterinea carinata* of Goldfuss."

Conrad describes (pages 64-66) from other localities some new species that are now known also from our area.

In the same volume, Vanuxem (1839, p. 272) says that "the water lime group of Manlius, . . . well characterized by its fossils," is "found from the Hudson to Cayuga Lake"; adding in the next report (Vanuxem 1840, p. 376), where he calls it the "Manlius water lime group," "I have traced it . . . to the hills in the rear of Hudson. It affords the most profitable limestone for burning of the whole series of limestone rocks, . . . requiring less wood to calcine a given measure . . . From Cayuga to Hudson river, kilns are arranged by the sides or upon the top of this rock." The Hudson reference is to Becraft's mountain.

This fourth annual report holds much on our region. Dekay (1840, p. 18-19, 26) lists fossil mammals. Professor Lewis Caleb Beck, chemist, and mineralogist of the survey, describes (Beck 1840, p. 40, 52) the quartz crystals of Diamond hill and along the Canajoharie and Catskill railway in Austin's glen, with other minerals from the Normanskill strata; also (page 60) gypsum at Hudson and (page 68) calcite on the railway in the glen, with a list of other minerals in Greene county and analyses of marl from near Catskill and of Lower Helderberg limestone from Austin's. Conrad (1840, p. 204-7)

describes further species from elsewhere that occur here too, and especially (page 206) *"Pleurorhyncus cuneus"* (now *Conocardium*) of which he says: "This is the fossil well-known as the bilobite, which is a crushed specimen."

In the same fourth report, Mather (1840) gave about six pages to our rocks and their local exhibition, under the headings "Hudson River Slate group, Helderberg group, Catskill Mountain group and tertiary and alluvial formations." He describes the first (page 212) as "consisting of slates, shales and grits, with interstratified limestones, all of which occur under various modifications," and says: "This group is overlaid unconformably in many places by the various rock formations of more recent origin." Further (page 257): "The Hudson slate group corresponds in many respects with the 'Cambrian system' of Professor Sedgwick, to which it may be a geological equivalent. . . . From Kingston, the Hudson slate group ranges along the right or western bank of the Hudson to Albany, underlaying the superincumbent rocks unconformably, with few exceptions." Coal had been sought in it (page 256) at Coxsackie.

Of the Helderberg group, which he describes (page 212) as "composed of various strata of common and hydraulic limestones of various colours and textures (enclosing a great variety of fossil remains), interstratified with grits and shales," he says: "It includes the limestones of the Helderberg, of Schoharie, Saugerties, Kingston, . . ." and (page 236) that it skirts the Catskill Mountain rocks "in a parallel zone, and underlies them, it is supposed, through their whole extent," while it extends from New Baltimore "southwardly, by Catskill and Saugerties, to Rondout." On page 238: "Near New Baltimore, Coxsackie and thence on by Catskill, . . . the principal masses of this formation are similar to those of Becraft's mountain, near Hudson and contain the pentamerus limestone, tentaculite limestone and water limestone. In some places the sparry limestone and shale are found in addition to the preceding, which are the principal extensive strata of this formation, in the district under examination this year." The names used denote respectively the Kalkberg-Coeymans, Manlius and Rondout; the Becraft and Catskill limestones of our map. As uses for these rocks Mather gives building stone, marbles, common lime and hydraulic lime.

His comments on structure (of the Helderberg rocks) are brief. (Mather 1840, p. 213): "from Kingston to Coxsackie, the rocks are upheaved, and sometimes overturned." (Page 241): "The cement beds and overlying limestones, up the valley of the Rondout, (and in fact north to New-Baltimore), are very much broken up, upheaved, overturned even, and contorted very much."

Mather's discussion (1840, p. 212, 213, 227-28) of the Catskill mountain group or series has been reprinted in Museum Bulletin 307 (Chadwick 1936, p. 7-11) except the following portions. After delimiting the group to "the high mountain region of Greene, Ulster" and adjacent counties, he goes on to say (page 213) : "The streams flow in deep valleys which seem to have been formed by erosive action, since the strata in most instances correspond on the opposite sides of the valleys. There are some exceptions, where there are indications of great fractures and rents of the strata, which traverse the country for many miles, and give direction to the streams." Does this refer to the supposed keystone fault valleys? He adds that the soils, though good, are laborious to bring under cultivation in the heavy timber.

His account of the minerals in cornstone (see note 5, page 121, *postea*), following his statement (page 228) that the group is barren of useful minerals, is incorporated into his final report (1843, p. 314), which is on the shelves of most libraries.

Under the head of "Flagging stones, grindstones &c." Mather (1840, p. 231) says: "The only rock of the Catskill mountain series that is applied *extensively* to useful purposes, is a bluish gray slaty sandstone which is quarried as a flagging stone." Saugerties and Bristol (Malden) are mentioned among shipping points on the river. (See Mather 1843, p. 318-19 for the rest.)

"The tertiary and alluvial lands," Mather says (page 213), "are level or with small hills. The former are generally terraces of nearly level land, at an elevation of 10 to 150 feet above the streams in the valleys." Under "Alluvions" (page 214) he lists "those of the Esopus creek . . . to near the Esopus Falls; those of the Catskill and Katerskill creeks; and the Schoharie flats" which he says "have long and justly been celebrated for their exuberant fertility." Speaking of the mud flats along the river, he remarks (page 215) : "The most extensive and important of these alluvial flats may be classed as *deltas* on a small scale and they extend some distance above and below the mouths of the Rondout, Esopus and Catskill creeks."

From the clays of the "tertiary" (page 226) : "Bricks are extensively manufactured in Greene and Ulster counties. The principal places of this manufacture are Coxsackie, Athens, Glasco, Catskill &c. and the average aggregate number made in these two counties may be estimated at 20,000,000 of bricks per annum." A further paragraph covering the "range" of the clay past these localities is reproduced in Mather 1843, page 131, and a mention of a sulphur spring (page 257) in 1843, page 93.

In the fifth (last) annual report Mather (1841, p. 66-67) gave further account of the progressive filling up of the Hudson with alluvium (see Mather 1843, p. 4-5), and (pages 72-73) of the glacial and postglacial deposits of the Hudson valley, correcting his former reference of the clays to the tertiary and correctly assigning them to an age between the tertiary and the alluviums, though not using the name Quaternary for them until 1843. His lengthy description of the Catskill Mountain series is mostly copied in Museum Bulletin 307 (pages 12-20) or repeated in 1843 (pages 302-7, 313, 316, 318-19), while the latter (pages 351-52, 368-69, 394) contains the essence of his remarks on the lower formations.

"A line of fracture and anticlinal axis," he says (page 64), ". . . passes near Kingston, thence on by the falls of the Esopus creek (half a mile east of them,) by Saugerties, along the ridge between Catskill village and the Katerskill creek on the road to the Mountain House; near Madison three miles northwest of Catskill; four miles west of Athens; . . ." And further: "On the west side of this axis of fracture and elevation, the rocks dip to the westward at variable, but generally at small angles, while on the east side, they dip at a high angle to the eastward and are frequently vertical in their stratification." In a footnote he speaks of "a great variety of curious contortions of the rocks." Madison is now Leeds, N. Y.

In this volume, Conrad (1841) reported Calymene Blumenbachii (page 38) from "the grit slate of Eaton" (now the Schoharie shaly limestone) "at Col. Clarke's, near Saugerties." The rock named is number 18 of his more complete but still faulty table of Silurian formations on page 31. The name Devonian seems here (page 41) to make its first appearance in these reports, including only the old red sandstone, and Conrad now writes (page 43) of the Carboniferous: "This system is not known to be represented within the limits of New York, unless it be on the summit of the Catskill mountain." On page 47 he lists it as among those that are wanting. He describes about 60 new fossils, (pages 48-57), of which a number occur also hereabouts, and particularly (page 55) two "Oriskany sandstone" (Glenerie limestone) forms from "near Saugerties," namely *Atrypa* (now *Leptocoelia*) *flabellites,* as "abundant," and *A.* (now *Plethorhyncha*) *pleiopleura.*

The great tomes on the natural history of New York followed, namely, for earth-science: Beck 1842 on the minerals, Dekay 1842 on zoology but with fossil mammals and a list of fossil fishes included, Vanuxem 1842 on the geological district to the west of Mather's but with matter bearing on our area as quoted or alluded

to beyond, and the geological map of the State (New York Geological Survey 1842; a second edition in 1844); then Mather 1843 on our district. Contemporaneous with the last was the paper of the brothers Rogers (1843) on the Appalachian folds to the southwest. Then came Emmons 1846 on the rocks and soils of New York. From this point onward it is unnecessary to dwell on more than the outstanding contributions; the others will in most cases merely be listed. Many titles included in the bibliography of Museum Bulletin 307 (Chadwick, 1936) and which have no further special bearing, are omitted entirely.

There followed a breathing spell while the world digested these herculean labors, broken only by Emmons (1854, American Geology) and Marcou's map (1855) of the geology of the United States and Canada. Emmons says (1854, p. 29): "The Hudson river runs upon a line of fracture which extends from New York to Montmorenci in Canada East, Lake Champlain being a wider and deeper fissure than that along which the river flows." Announcement of this great overthrust is generally credited to Logan, of Canada, in 1863.

In 1858, Dr John J. Bigsby, an Englishman, gave an extended review of New York geology and in the same year Professor Andrew C. Ramsay, later director of the geological survey of Great Britain, described glacial features of the Hudson valley and Catskill mountains, giving a map of the striae in the vicinity of the Mountain House and a section of the Kaaterskill clove "below the Falls of Catskill, showing boulder-drift covering its sides." (For Hall's mention of his visit see Bulletin 307: 51.)

Publication of the Paleontology of New York by James Hall was already actively under way. In 1859 appeared the great volume on the Lower Helderberg and Oriskany fossils, with plates bound separately, and including many mentions of localities within our area where the given species had been found; but more important is the review of the geology of New York and all eastern North America constituting the 96 pages of Introduction. (The distinction between Lower and Upper Helderberg had been made by Hall in 1851.) This was followed in 1861 by Lincklaen's summary (museum guide) of the stratigraphy of New York. Each of these marks progress in knowledge of the rocks of our area. Minor papers are those of Hunt 1864, Dwight 1866.

The brachiopods of our middle Devonian appeared in the next volume of the Paleontology (Hall 1867); then a compendium of all Silurian fossils by Bigsby (1868), and in 1869 the large scale map of Canada and adjacent states by Logan and Hall. Vigorously

working on our fossils, Hall put out in 1874 the descriptions of bryozoa and corals of our Lower Helderberg, the figures not issued till 1879 and the whole volume in 1883, and another (very rare) book of plates of middle Devonian corals in 1876. In the latter year there was a paper by Rossiter W. Raymond (1876), on the Burden iron ore; in 1877 came the first edition of S. A. Miller's compendium of American Paleozoic fossils and in 1878 Bigsby's of all Devonian fossils.

Callaway (two titles, 1878) was an English professor temporarily at the State Museum, bringing English ideas to bear on our rocks and their correlations. Sherwood's section (1878) of our red-beds was based on a suite of specimens deposited at Albany which was discarded when the Museum moved into the Education Building. The year 1879 saw another volume (plates separate) of the Paleontology (Hall 1879), comprising the middle Devonian univalve molluscs, and the first edition of Macfarlane's geological railway guide. The miniature folding of our limestone belt came as a new discovery to Professor Nathaniel Southgate Shaler (1879) of Harvard University, who at about that time, in conjunction with Professor William Morris Davis, his colleague, began bringing geological parties to Catskill. Davis's papers are mentioned shortly.

The influence on geological thought of Professor James Dwight Dana's great "Manual of Geology" has not been noted in these pages. Dana fell heir at Yale to Silliman's mantle, having married Silliman's daughter, and became the leading geologist of our country. His manual went through five editions, in 1863, 1864, 1875, 1880 and 1895. The 1880 edition (denominated the "third") still holds pretty closely to the nomenclature and classification of the earlier ones, as far as our region is concerned, and still puts the Lower Helderberg and Oriskany in the Silurian, where Hall had them in 1859. In 1880 came Guyot's important paper on the altitudes and physiography of the Catskills, pointing out the peculiar cross-direction of the ranges, the unsymmetrical development of the spur-ranges on west side only, the abnormalities of drainage and the suggestion of what we would now call a peneplain in the decline in both directions of their summits from a ridgepole of the three highest peaks (see pages 229 and 232). A short paper by Julien was published in 1881.

Davis's paper of 1882, the first working out of our folded structures, was epochal and was followed by three other illuminating articles in the next year that focussed attention on the marvelous development here of Appalachian tectonics and physiographic types in convenient compass, with a concentrated cross section of nearly

the entire New York series of the Paleozoic, and brought the world to our doors.

In 1883 also, Hall on bryozoa and corals (two titles) and the second edition of Miller's fossil lists preceded the appearance (1884, 1885) of Hall's two volumes of the Paleontology comprehending the middle Devonian bivalve molluscs and completing volume V (in four covers). Beers (1884), partly written by Henry Brace, included various pages on local geology. Smock (1885) raised the question of local glaciers in the Catskills. In 1887 Hall brought together his accounts of the corals and bryozoans of our Lower Helderberg and of middle Devonian bryozoans, in volume VI of the Paleontology. A paper by Hinde (1887) is on a fossil sponge, abundant in our Kalkberg limestone and higher.

Dr John Mason Clarke, Hall's equally illustrious successor, collaborated in volume VII, appearing in 1888, in which year Professor Ashburner of Pleasantville, Pa., the oil and gas expert of the survey of that state, gave a summary of the rocks and their thicknesses in our mountains and the log of a deep well drilled (unsuccessfully) for oil near Cairo.

Then came (1889) Clarke's important paper (with a second one in 1891) opening up the question of the Devonian age of our Lower Helderberg rocks, instead of their being Silurian as so long regarded, a proposition that gained favor but is now being reexamined; in the same year, Newberry's monograph of fossil fishes, largely from other parts of the country, Ward's long compilation on fossil plants, including "fucoids" and the Bilobite of Dekay, the new enlarged compendium of Miller, and Upham's discussion of mountain glaciation appeared, with Hubbard's first mention of the pothole at Church's opposite Catskill; in 1890, Beecher, Kimball, Smock, the second edition of Macfarlane (inaccurate as to the Catskill Mountain Railway, supplied by W. B. Dwight); in 1891, Beecher, Hall, Prosser, Clarke's second paper on the Lower Helderberg as Devonian, and Ries (two titles) on our clays.

In 1892, Beecher announced the finding of the Oriskany (later the Glenerie) at Becraft's mountain, giving a list of fossils by Doctor Clarke; there also were papers by A. H. Cole and W. M. Davis, and Miller's first appendix to his compend. More important were Darton 1893, Hall and Clarke 1893, Willis's great work in the same year on the manner of formation of folds such as we have in our limestones (no local mention). Darton's two reports in 1894 have much on our area and it is worthy of note that with Nelson Horatio Darton of the U. S. Geological Survey and Professor Heinrich Ries of Cornell

we come to the first names of men now living who have worked in our quadrangles. Both made lasting contributions. Nason's report (1894) accompanied Darton's. There was a popular article by Ingram (1894) on flagstone quarrying and McGee's large geological map of New York State, an enterprise long awaited and eagerly welcomed, in which the state and federal surveys co operated.

In 1895 the new (and last) edition of Dana's manual put the Oriskany into the Devonian and reflected the newer thought of the red-beds in our mountains as a facies rather than a formation. Instead of deposits of a lagoon, estuary or fresh-water lake (as previously they had been considered), Dana now calls them "sea border deposits," which was a step ahead of calling them marine as he did in 1880 (page 290), and it is specially worthy of note that he extended them down into the Hamilton (pages 576, 603). There is also Bather 1895.

In 1896 Darton called attention to stream piracy in the Kaaterskill and Plattekill cloves. Ries (1897) also referred to the Hamilton the red shales near Cairo Roundtop used for paving brick manufacture in the newly opened shale-brick plant at Catskill. Paleontological papers in that year include Girty 1897, the second appendix to Miller, and Schuchert's synoptical index to our fossil brachiopods. Merrill's bulletin 19, in 1898, with its wealth of illustration, a glorified and modernized edition of Lincklaen's guide, was unfortunately soon out of print. The report by Prosser (1899) and the bulletin by Ries (1899), the papers by Eastman and by Grabau, and Clarke's handbook (1899) all concern our area, but are overshadowed.

For late in that year, with the turn of the century, came Clarke and Schuchert's epoch-making, sweeping revision of our stratigraphic nomenclature and classification, immediately republished in Clarke's memoir (1900) on Becraft's mountain; in 1900 also, Nickles and Bassler, Osborn, Schuchert; in 1901, Brigham, Clarke, Ries and the greatly improved new geological map of the State (not yet superseded) compiled under F. J. H. Merrill, the new director of the state museum after Hall's death, and explained by him (Merrill 1902) with a summary of the history and evolution of the study of New York strata; in 1902 also, two papers by Clarke, now state paleontologist, and one by Ulrich and Schuchert explaining by an ingenious theory of barriers and basins (troughs) some things that we now understand as due to facies. The year 1903 has Clarke (three titles), Dickinson, Grabau, Hartnagel, Prosser, Schuchert, Upham, van Ingen and Clark, and Whitlock, the most novel of these being Hartnagel's determination of the "Coralline" (Cobleskill) limestone as of Cayugan instead of Niagaran age.

In 1904 came Grabau (two titles), Jackson, New York State Museum, Peet, Ruedemann, Ulrich and Bassler; in 1905, Clarke, Hartnagel, Rafter, Talbot, Upham and particularly Woodworth. (In 1905 also began the long series of annual bulletins by David H. Newland, later with Hartnagel, on the mining and quarry industry of New York, not included in the bibliography chapter.) Grabau's work in 1906 contains a good deal on our area and is useful locally for its figures of the characteristic fossils of the various formations. In that year, John Lyon Rich announced his discovery of an indubitable local glacial circ and moraine in the Catskills, west of Prattsville. Clifton James Sarle, 1906, showed the burrow nature of the supposed algal plant (fucoid) *Taonurus cauda-galli* of our Esopus shale and opened a new field of thought concerning many so-called fucoids. George P. Merrill's indispensable history of American geology came out in the same year. The eminent mineralogist, Samuel Lewis Penfield of Yale University, a native of Catskill, passed away in his prime; his biography was published by Miers, 1907.

In 1907, besides Eastman's memoir, appeared a paper by Professor Angelo Heilprin of the University of Pennsylvania accompanied by a beautifully engraved map reduced from the topographic sheets (American Geographical Society 1907), on our Catskill mountains. This map is still purchasable in New York or Catskill.

In 1908 came Berkey, Chadwick, Grabau, Ruedemann, Salisbury and Atwood; in 1909, Clarke, Cook, Grabau, Grabau and Shimer; in 1910, Chadwick (two titles), Schuchert, Whitlock; in 1911, Berkey, Merwin, Rich, Ulrich; in 1912, Berkey, Chadwick, Clarke (two titles), Clarke and Ruedemann, Grabau, Hartnagel, Stevens, Willis. Many of the above are large and important works but with little local matter.

The most illuminating paper of the period was Barrell's (1913) on our great Devonian delta, which gave an entirely new slant to the whole problem of the red-beds. The same year has Chadwick, W. B. Clark, Eckel, Grabau; in 1914, Brigham, W. J. Miller; in 1915, Bassler's index of fossils, Clarke (three titles), Collison and Barker, Grabau, Prosser and an interesting paper by Rich, himself a native of Hobart in the Catskills. Two more papers by Barrell in 1916 developed further his invigorating new concepts of our upper Devonian. In the same year came Brigham, Chadwick, Johnson (not local), Newland; in 1917, Barker and Baer, Barrell, Bowles, Elston (not local), Johnson, Rich (three titles); in 1918, Clarke, Fairchild (two titles), Rich, Stansfield (not local), van Tuyl (not local); in 1919, Fairchild, Robert Weeks Jones.

In 1920, besides Bucher, Merwin and George F. Wright, there was Daly's paper on the bulge peripheral to the great ice sheets, a concept long held in Europe but slow of headway here; in 1921, T. H. Clark, John M. Clarke, two papers by Miss Goldring, Grabau's textbook with local matter, Lobeck's clever diagram-map, Newland's mineral resources of the State; in 1922, Cook, Davis, Goldring, Hartnagel and Bishop, Reid; in 1923, Miss Goldring.

John H. Cook's paper (1924) emphasized the stagnation of the glacial ice sheet in its final waning; in that year, also came Miss Goldring, Grabau, W. J. Miller; in 1925, Bancroft, Barrell, the Crosbys (father and son) on keystone faults, Fairchild, Goldring, Schuchert; in 1926, Coleman, Dorsey, R. W. Jones; in 1927, Chadwick, Goldring, Percy W. Raymond, Schuchert; in 1928, Alling, Chadwick, Fenneman; in 1929, Adams, Fairchild, Burnett Smith; in 1930, Cook, Fenneman, Grabau, Hubbard and Wilder, Leverett, Ruedemann, Schuchert's important paper, Ulrich and Ruedemann (1931).

In 1931 were Chadwick, Fullerton and Cox, Goldring, Ruedemann; 1932, Chadwick, Fairchild, Lobeck, Ruedemann (two), Schuchert and Longwell, Ver Wiebe; 1933, Berkey, Chadwick (five), Kay, Longwell, Mackin, Newland and others, with two important papers by Dr Gustav Arthur Cooper of the National Museum; in 1934, Bassler and Kellett, Bassler, Fenton, Pepper, Rich, Ruedemann; 1935, Ashley, Chadwick (eight), Cook, Cressey, Goldring, Henderson, Parks, Ruedemann, Willard, Robin Willis, and Rich's great bulletin on the glacial geology of the Catskills.

In 1936 came Chadwick (N. Y. Mus. Bul. 307 on the name Catskill in geology), Cooper, Meyerhoff and Olmsted, A. K. Miller, Parks, Rich, Ruedemann and Wilson, Zodac; and in 1938, W. Storrs Cole, Fenneman, Grabau, Mackin, Meyerhoff and Olmsted, Ruedemann, Swartz, Wilmarth. See addenda (to 1942) on pages 233 and 234.

The principal topics of debate at the present time in our area are physiographic and glacial—the evolution of our drainage pattern, the number, location and age of the peneplains, the extent of late Wisconsin local glaciation, the manner in which the ice departed from our terrane, the history or existence of "Lake Albany," the effect of the hypothetic peripheral bulge—but also the times of mountain making, the significance of the breaks in the stratigraphic succession, the levels at which we should draw period and epoch lines, the precise correlations in what is herein called the Rondout, while in the mountains the whole subject of formational boundaries and their tracing is still wide open. Petrographic study of our sediments has but just begun. The preglacial courses of our streams are

almost unknown. The search for fossils and fossiliferous horizons is far from complete. New problems await discovery. The geology of a region is never finished.

THE ROCK FORMATIONS

The Silurian and Devonian bedrocks of our quadrangles are all sedimentary, that is to say they are water-laid deposits, and consequently they are distinctly stratified or in regular layers. Moreover, with the exception of the upper part, namely the flagstones and red-beds, at the west, they are all marine; that is, they were deposited in salt water and they contain fossil remains of sea animals not unlike some of the smaller ocean creatures of today. The highest members, the red-beds and flagstones, contain land plants, besides shells peculiar to fresh waters and fresh-water or anadromous fishes, only; from which it is clear that they were laid down in the open air—are "continental" deposits.

Twenty divisions or "formations" are now recognized by name in the Silurian-Devonian succession of our map area, though but 16 colors have been employed on the map to represent them, chiefly because of the thinness of some of them in the valley or of the still rather indefinite limits of the newly defined members in the red-beds of the mountains.

The complete list, in proper order with the highest at the top, is:

DEVONIAN	Upper	Katsberg sandstones and red shales, with Stony Clove gray flagstones at base	
		Onteora puddingstones, flags and red shales	
	Middle	Kaaterskill sandstones and red shales	
		Kiskatom red shale, with flagstones	
		Ashokan gray flagstones and olive shales	
		Mount Marion shales and sandstones	
		Bakoven black shales	
		Onondaga limestone	
		Schoharie mud-limestone	
	Lower	Esopus shale	
		Glenerie limestone and cherts	
		Port Ewen limestones, with Alsen cherty limestone member at base	
		Becraft limestone	
		Catskill shaly limestone	New Scotland beds
		Kalkberg cherty limestone	
		Coeymans limestone	
SILURIAN	Upper	Manlius (Olney) limestone	
		Rondout waterlime (Fuyk sandstone locally) with Glasco limestone lentil near top	

These beds will now be described, beginning with the oldest, or bottom, ones. Their total thickness on our quadrangles approximates eight thousand feet. This means that the waterlimes exposed in the Kalk Berg front must go four thousand feet below sea level under

Hunter mountain. It means also that at least these eight thousand feet of strata, perhaps an additional one or two thousand feet, once extended eastward over the sites of the present villages of Catskill and Saugerties, and of the city of Hudson.

1 RONDOUT WATERLIME

To speak of the Rondout formation[1] in our area under its established name of waterlime is to tell but a fraction of the story. Over a considerable section of its local outcrop it is a massive sandstone (figures 11, 15), running as high as 94 per cent of silica in some exposures. Through a long stretch, also, its conspicuous member is a highly fossiliferous and attractive "coralline" limestone ledge (figure 14), formerly mistaken for the Cobleskill limestone.

As variable as its lithology is its thickness. Entering our map-area from its type region around Kingston, it is thicker than there and can not be far short of 40 feet though exposure of both top and bottom contacts is lacking. Three miles north it has seemingly decreased to not much over 30 feet, which thickness it appears to maintain past Saugerties nearly to West Camp. In the unbroken section at Cementon, where route 9-W goes under the cable-bucket line, there are almost 30 feet, which is thought to be essentially the whole thickness although neither the soft Normanskill shale below nor the Manlius paper shale is here seen in contact. Thence north the loss of basal beds is marked, as the sands replace most of the limes. Beyond the Red Schoolhouse, where about five feet of very fossiliferous limestone (absent to north) is overlaid by still nearly 20 feet of Fuyk sandstone, the thinning of the sandstone is more rapid, so that within a mile it has almost ceased exposure. At the north end of this syncline the whole Rondout is not much over five feet thick, less than two north of Cauterskill and only six or eight feet as it goes off the map.

This variability is in keeping with its origin as the deposit of an encroaching sea transgressing over an eroded land-surface of older rocks. The distribution of the sandstone member (Fuyk sandstone) suggests that that is precisely a wave-built sandbar and the comparative absence of marine fossils on its lee (east or landward) side in contrast with their exceptional abundance on its wave-swept outward slope is consonant with the idea of lagoons hemmed in behind it. The northward extension of such thin and barren stuffs around the Helderberg front accords further with the inferred conditions. Only as we go west again across Schoharie county does the Rondout (Chrysler) resume

its normal thickness and aspect, with marine fossils, though without return of the organic reefs that margined its southeastern shore. Landward, behind the strand, it is a dirty and variable deposit of small bulk.

As might be expected, exposures of this thin formation, tucked away beneath the massive Manlius cliffs and overmasked by their talus, are infrequent in the north part of the quadrangle (figures 12, 13). Farther south, the Fuyk sandstone and the Glasco limestone lentil make at times outstanding ledges, crags and terraces over the rest of the map area. The most notable long gap is between a mile north of Schoentag's, on route 9-W, and Fera's hill east of Katsbaan Church, five miles throughout which the Rondout outcrop goes under sands or clays except for the crest of one close-pinched anticline of Glasco limestone on the north corporation line of Saugerties village, midway.

The passing motorist on route 9-W can see the whole thickness (10 feet) of the massive Glasco limestone and something of the few feet of waterlimes above it up to the ledges of Manlius, on the west of the highway north of Schoentag's from the big old quarry northward behind the chicken-yard at West Wood farm. Requiring walking but repaying a visit is the Limekiln hill west of Flatbush school, which is rimmed around on all sides by the ledges, under a Manlius cap. This is on route 32. The unbroken Cementon section already mentioned is in the road cut of 9-W at the "aerial tramway." On this highway at the Alsen underpass, in the cut opposite the Alsen railway station and in the hilltop cut beyond the North American cement company, are conspicuous exposures of the Fuyk sandstone where it still has limestone interbeddings. By the roadside, also, is the exposure (Davis 1882, p. 24) at the north end of Quarry Hill.[2]

Two north-south lines a half mile apart will embrace all the heavy sandstone exposed on route 9-W and in the Fuyk, but to match similar sections these lines must be swung five degrees west of north thus widening the belt to nearly a mile. The same direction gives the best matching of sections in the limestones southward, is employed in the construction of figure 11, and may represent the trend of the Silurian shore line hereabouts, as far as the Helderberg front. Curiously, the cleanest-washed, most quartzitic portion of this sandstone occurs on its seaward (west) side where interbedded with purest organic limestone, from Alsen to the North American plant. Here it has been called "Binnewater" by field parties, from a lithologically similar sandstone that underlies all the Rondout from Kingston (Wilbur) southwestward. Our rock is of later age, is not connected

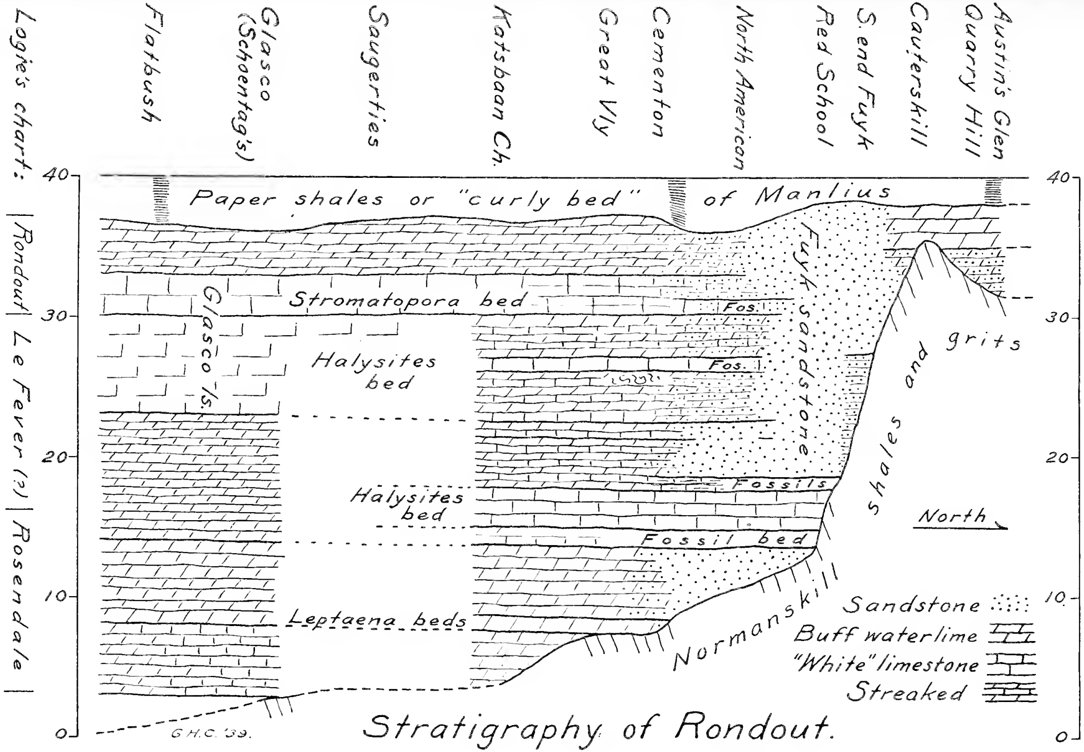

Figure 11 Preliminary correlation chart of the Rondout formation across the Catskill quadrangle, based on the mostly imperfect and unsatisfactory sections and exposures. Vertical sections accurately drawn to scale; horizontal spacing as projected north 5° west, in the direction of the Fuyk sandbar, which brings all sections into harmony. Only uppermost beds exposed past Saugerties. Logie's identifications approximately given in left margin.

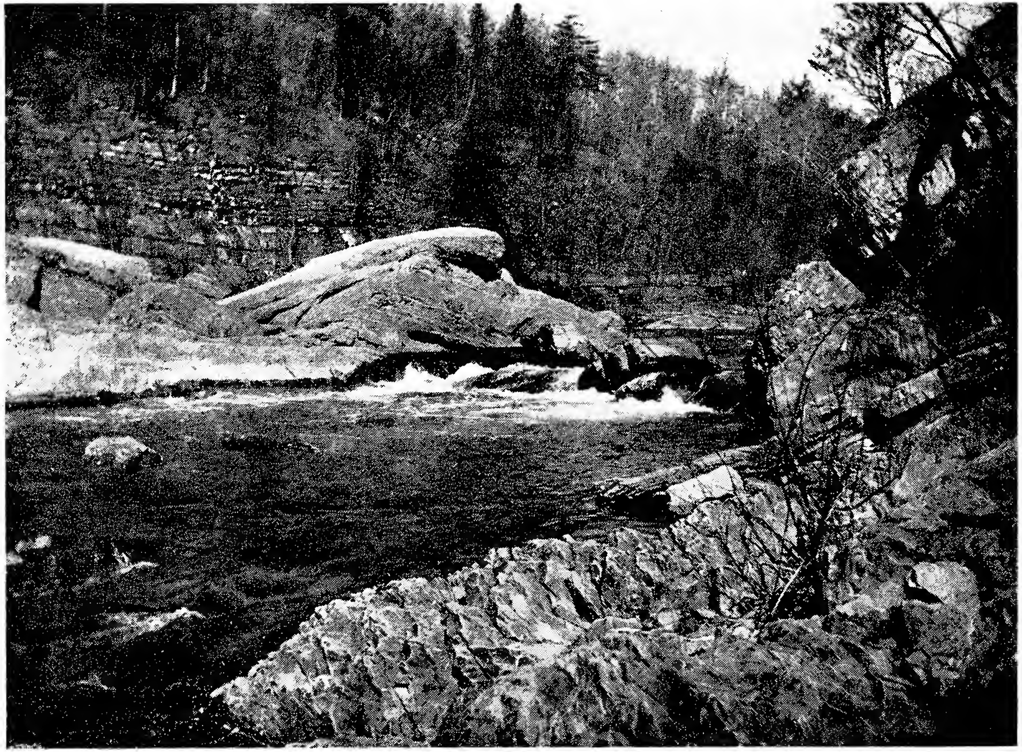

Figure 12 Rondout waterlime and higher strata on Cats kill in Austin's glen, to right of figure 58. Shows two fault-wedges of hackly (upper) Rondout in foreground, overthrust by Rondout sandy layer topped by third slice of the waterlime, behind the shrub. A fourth wedge of Rondout concealed beyond, beneath heavy Manlius, which crosses the creek. Distant cliff is New Scotland; see figure 25. Looking northwest. Photo: April 1921, Edith Nusbickel.

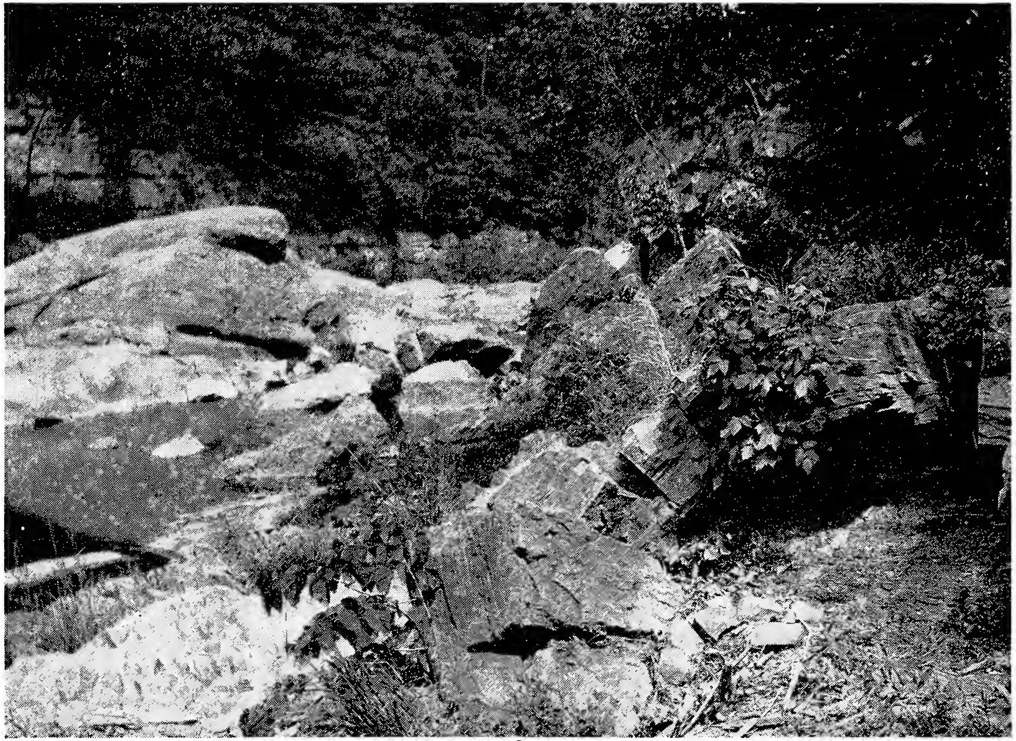

Figure 13 Part of an S fold in sandy (lower) Rondout, just to right of figure 12, enwrapping horizontally bedded soft Normanskill shale. Hackly waterlime wedges of figure 12 down left. Just under camera, middle limb of fold is overturned nearly 200°, then rolls back to cross creek at figure 58. Manlius does not participate in this contortion. Looking west of north. Photo: August 1912, H. L. Fairchild.

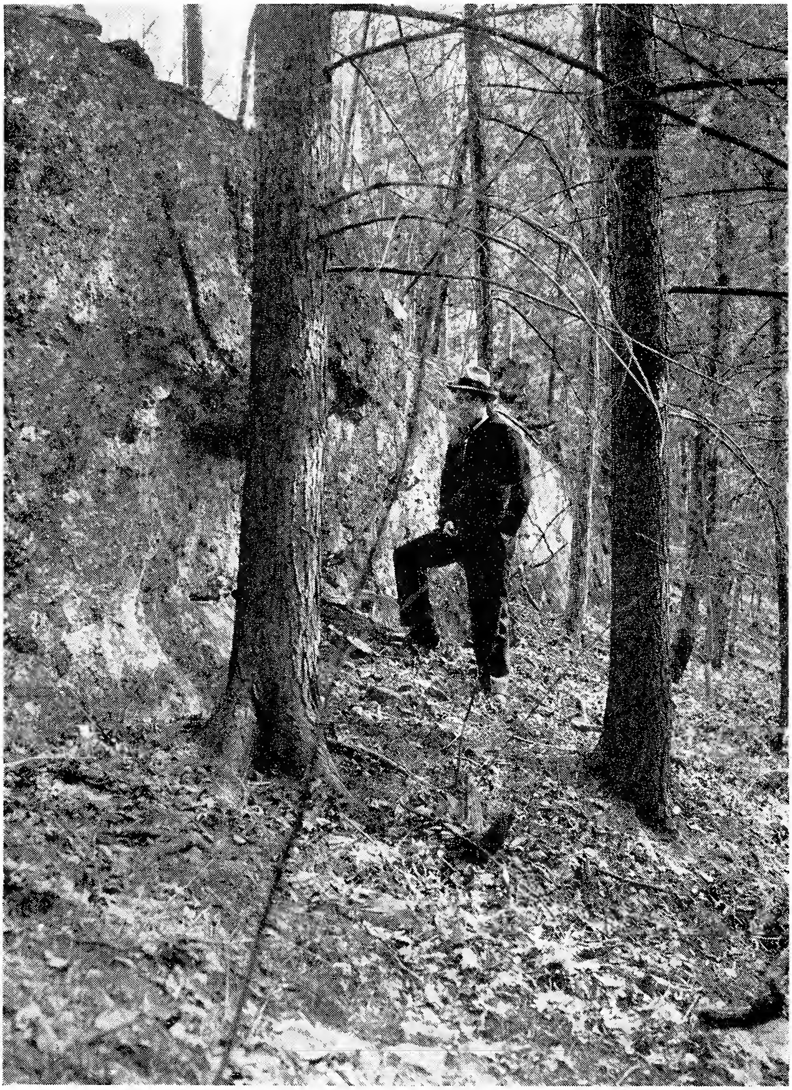

Figure 14 Rondout (Glasco) limestone on west slope of Limekiln hill, Flatbush, two miles south by west of Glasco. A major joint face on this reef rock full of corals and bryozoans. Mr Kilfoyle gives a measure of thickness. Looking south. Photo: April 1938, W. J. Schoonmaker.

with the Binnewater and is here called the *Fuyk sandstone* from the fine ledge of figure 15 overthrust on the west ridge of the Fuyk, west of Catskill (Chadwick, 1927).

The diagram (figure 11) shows the inaccuracy of trying to apply the name Le Fever to the limestone lentils in our area. Mr Logie's chart indicates that that limestone lacks continuity with these across the Rondout area nor do they agree with it in vertical limits. Therefore, to the conspicuous ten-foot ledge seen at Flatbush and Schoentag's (Glasco) the name *Glasco limestone* (lentil) is here applied, with type exposure on the West Wood farm, route 9-W, west of Glasco.

The unconformable contact of the Rondout on the Normanskill is described in a later chapter, with the localities where it may be observed.

Awaiting Mr Logie's monograph on the Cayugan rocks and fossils of New York,[3] it is probably safe to record at present the following species from these Rondout limestones in our quadrangle:

1 the ostracod, *Leperditia jonesi;*

2 the trilobites, *Corydocephalus ptyonurus* and *Calymene camerata;*

3 stems and fragments of crinoids;

4 the brachiopods, *Leptostrophia bipartita, Camarotoechia litchfieldensis, Chonetes jerseyensis, Atrypa reticularis* and *Leptaena rhomboidalis;*

5 the corals, *Halysites catenularia* and *Enterolasma caliculus;*

6 the alga(?), *Stromatopora constellata?.*

Supplementary Notes

[1] The taxonomy of the old "Waterlime group" is in confusion. Mather (1843, p. 349), in common with his colleagues, separated this group from the Onondaga salt group under it, and united in it (page 350) both the "Water limestone" and the "Tentaculite limestone" above that. The latter is approximately our Manlius, though at some points Mather included in it (as a "lower part," page 350) some fossiliferous beds (Glasco, etc.) of the Rondout while conversely at others (page 331) by implication he extended the "water limestone" up to include a cement bed that is in the Manlius. The important thing to note is that these rocks were not considered by any of these men as of Salina age but were always associated by them instead with the Manlius. Hall in particular (1843, p. 128-29, 141) took pains to discriminate between them and the hydraulic cement beds or water lime in the upper part of the Salina (then Onondaga) salt group.

Half a century later (1893, p. 159), Hall applied the name Rosendale limestone to the entire series of cement rocks quarried at Rosendale, N. Y., southwest of Kingston. This name was promptly forgotten. The next year (1894, p. 16), Hall reversed his early position, referred these cement beds of our region to the top of the Salina group and made them equivalent to the (Bertie) waterlimes of western New York, which lie below the Akron (Cobleskill) limestone. In the same report, Darton (1894, p. 400, 410) discussed them as the "Salina waterlimes." Subsequently Clarke and Schuchert (1899, p. 876) renamed the whole series the *Rondout waterlime,* assigning it anew a place

between the Salina and the Manlius. The terms Rosendale and Rondout are thus originally synonymous, for the whole group.

Nevertheless Hartnagel (1903, p. 1166), after stating correctly that the name Rondout was intended to apply to "the upper beds of the Salina," gave it quite another meaning restricted to the part of our waterlimes that he considered as later in age than the Salina, while to the subjacent "waterlime of the Salina" as he then understood the correlations he reapplied (1905, p. 355, 356, 358) in a thus limited sense the forgotten term Rosendale. This was because of his belief that a "coralline" limestone lentil intervening between these two waterlimes was the Cobleskill limestone at the base of the (comprehensive) Manlius group of Vanuxem and of Schuchert. Still beneath his restricted Rosendale, Hartnagel recognized another "coralline" limestone by the name Wilbur (1903, p. 1145; Clarke 1903, p. 857), which was preoccupied.

Hartnagel's subdivision of the former Rondout or Rosendale waterlime group into Wilbur limestone and Rosendale waterlime of Salina age, and Cobleskill limestone, Rondout waterlime of post-Salina ("Manlius") age, has remained in current use. Meantime Chadwick (1930, p. 81) introduced a third term, Chrysler waterlime, for beds called Rondout in central New York, lying between the Akron (Cobleskill) and Manlius (Olney), because of his belief that they were not coextensive with the Rondout as that name was being used in the Hudson valley.

In his rather recent tracing of the Manlius and "waterlime" beds across New York (unpublished), Russell M. Logie has confirmed this belief that the Chrysler covers a greater interval than the restricted Rondout, but one practically identical with that of Rondout (or Rosendale) in its original scope. He finds the "coralline" limestone between Hartnagel's Rosendale and Rondout to be later than the Cobleskill and renames it the LeFever limestone. The name Rosendale he extends downward to include the true Cobleskill horizon and the lower "coralline" zone, but rejects the name Wilbur as not representing this bed at the Wilbur type exposure.

The terms applied around Kingston, N. Y., therefore stand thus:

1843 *Mather et al.*	1893 *Hall*	1899 *Clarke and Schuchert*	1903, 1905 *Hartnagel*	1933 *Logie*
Tentaculite.	Tentaculite.	Manlius.	Manlius.	Manlius (Olney).
Water limestone (i.e. Cobleskill and higher).	Rosendale limestone (1894 Salina, below Cobles.).	Rondout waterlime (above Salina; Cobleskill not named until 1902).	Rondout.	Rondout.
			Cobleskill.	LeFever.
			Rosendale.	Rosendale (with Cobleskill horizon).
			Wilbur.	

In the Catskill quadrangle the entire series of these beds behaves as a unit and is not subdivisible into distinct formations. Limestone lentils come and go in the waterlimes, fossils of the Cobleskill congeries appear at all levels in increasing abundance as the beds lap against the Fuyk sandbar, what seems a valid classification at any given locality fails at another. Regardless of who may be right as to the position of the Cobleskill limestone with reference to these beds, there is here found no such continuous and sharply delimited stratum as is the true Cobleskill (Akron) from Schoharie valley into southern Ontario, Canada. Logie has rightly limited his Le Fever limestone, a massive lentil, to the country from Wilbur (Kingston) southward, indicating doubt as to correlation of it with the lentils of our area. Our chart (figure 11) shows how it fails, as a term and as a subdivision, to accord with the field facts here. However minutely, in Kansas fashion, we may some day divide this less than forty feet of strata, we shall always need a single name for the entire span.

As such a name for these waterlimes as a whole, Rondout in its original and comprehensive sense has a better claim and more familiar sound than either Rosendale or Chrysler. It retains the familiar succession (if Logie is right): "Cobleskill, Rondout and Manlius." Again (if Logie is right), it agrees with Mr Hartnagel's intention so to use it, an intention defeated only by probable misidentification of the Cobleskill in our region. This leaves Rosendale for employment in Hartnagel's (restricted) sense, its original claim having been lost through immediate disuse by its author or others, and makes Chrysler

an unnecessary synonym, though it is "runner-up" for our beds in case a return to Rondout for them is not found acceptable. For Rondout in Hartnagel's restricted sense there is all ready a much older name, the Stormville waterlime of White (1882, p. 136-37) which White correctly identified with the "great waterlime bed at Rondout, Kingston and Rosendale, N. Y."

Finally we have the name Decker Ferry limestone (White 1882, p. 137; Weller 1903, p. 62) which originally included all but the uppermost 5 to 10 feet of our waterlimes, but which Hartnagel (1905, p. 348-49, 358) used in a narrower value. It would be a small matter to stretch Decker Ferry upwards the few feet needed to include everything up to the base of the Manlius (compare Kay and Chadwick 1933, p. 3, 5, 15), if that were desired, though this would not be as historically accurate as to go back to the original Rondout, the course here chosen.

One point, however, must be made clear. The base of the Manlius at Rondout is not where various writers have put it (above the third cement bed; see Mather 1843, p. 331; Van Ingen and Clark 1903, p. 1183; Hartnagel 1903, p. 1142), but at the base of the "curly bed"—a persistent but highly incompetent paper shale or shaly limestone that curls up like tinsel in the folding of the strata, beneath the massive beds gliding over it. The changes in thicknesses thus involved are, at Rondout:

	Formerly		As amended		Logie's
Manlius	37½		51¾		46
Rondout	23¾	41¼	9½	27	25½
Etc.	17½		17½		
Totals	78¾		78¾		71½

[2] For the future student of these beds, the following notes are given. Small exposures occur from the south edge of the sheet to the first crossroad. At forks of the Y of this road, exposures are good in both directions and north for some rods. Fossiliferous disrupted masses continue north to the Limekiln hill and also make a boulder moraine tailing south to and across route 32 below the corners. The lower beds exposed down past the vineyard on the southwest slope of Limekiln hill should not be overlooked. On the main ridge to the west of this hill nothing has been seen in place north to Mr Wetzler's house, which is a mile south of Schoentag's terminating a private road. On the east side of the limestone ridge just around the north end of it from his house, a good ledge of the Glasco is found resting up against a Normanskill knoll, with extension southward. North across the marsh, in the south end of Schoentag's hill, the Rondout rises rapidly, to make a commanding crag facing east at a high point on this ridge. It declines under cover before the elbow of the farm road on east is reached, but halfway from this to the Glasco road it shoots up very suddenly, under ascending Manlius ledges, and is largely uncovered in a small road-metal pit beside the farm road, with other exposures beyond for a space. Next comes the excellent strip north of Schoentag's past West Wood farm, northwest from which, across a brook, are various fine ledges at different elevations and with diverse dips, as well as others southward up both sides of the brook valley. A quarter mile north, beyond the backset of the hill, there are weaker ledges up the slope at different levels, but these soon pass under cover.

The anticlinal hogback on the north limits of Saugerties at Canoe hill is just behind a modern house. If there are any other exposures on Canoe hill or on Bambach's hill next north they have escaped me. Where the road east from Katsbaan Church hits the limestone ridge and Mr Fera's road forks from it, a climb straight over the hill brings one to the next known exposures, on its east foot. For a half mile north, though not continuously, the Rondout regains something of its self-assertion, with a white limestone bed carrying Halysites in a thin seam of flint that keeps mostly just west of the road under the east front of Shults's hill and forms more or less of a terrace that even crosses the road into an orchard for a few rods, then shows up well in the farmyard beyond. The next exposures are two skin outcrops on the west edge of the Great Vly a few rods north of the Asbury road. Less than a mile north, the Rondout picks up again as a distinct terrace above the Vly and continues at intervals north to the old stone house at the head of the Vly. North of

the house it spreads east across vertical ridges of Normanskill into a broad cuesta as far as the cement company's railway cut into their back quarry. It arches back over the knoll north of their engine-stable and does not extend much north of their access road but comes back south on the east side of the Vly above their track until it forms the roof of the tunnel portal. With short covered spaces it continues through to the cemetery above West Camp, being specially well displayed for over a half mile northwest of there to the thumb of this hill and in the road that crosses.

On the east side, at West Camp, the Rondout comes down to road level of 9-W at the first scattered houses north of the store, then is largely covered to the crossroad, which it crosses just above the hairpin turn and is lost again to the West Shore cut south of the cable-bucket line, continuing into the fine section on route 9-W previously mentioned. Thence northward it leads a vagarious life in the faulted and plicated east front of the Kalk berg. Just north of the bucket line a second wedge comes in on the sidling road behind the house west of the railway. This wedge runs along the hill slope and into the big railway cut on the curve to north. Meantime a third one enters above it, crosses above the brick house and also comes to the tracks, at north end of the cut, reappears at the underpass and climbs toward the quarries. A fourth wedge makes the east wall of the southeast Alsen quarry with specially good sections, as are those north along the service railway and in the highway cut opposite the Alsen mill of the Lehigh company. The interbedded limestones are suggestive of Manlius or sometimes of Coeymans, and this is particularly true as one approaches the North American plant where various splits and wedges have mixed the strata badly. Besides the exposures along the road, here, there are important ones down along the West Shore tracks showing beneath the limestone a basal sandstone two or three feet thick that consists of reworked Normanskill and is distinguishable from that only by slightly coarser grain and more calcareous content (ground-up crinoids). These beds run up to the highway, halfway down the winding hill, where the same basal bed may be climbed to and found unconformable with the true Normanskill. Behind (west) and parallel runs another rib of the sandstone (Fuyk) farther up the hill. The easterly one persists, fishhooks over a north-plunging anticline in pretty fashion and returns to the highway where that runs close to the tracks, then arches up from the filling station, goes under the spring and climbs to the top of the roadhill above the red schoolhouse. Meantime the upper rib resumes above it on the steep hillside for a space.

Mrs Young's house is next north of the school. Up the slope behind her house are some of the most picturesque crags of the Fuyk sandstone, again in two strips, the lower one double. These all coalesce north, and at intervals crop out, dropping toward the road at the next filling station but losing thickness and presently becoming practically lost in the talus. No exposure was noted thence, short of the Quarry hill. Just where the upper waterlime bed comes in is not known. From the Cauterskill road exposure around to Moon's spring on the Fuyk farm road, exposures are scant. When the talus of Moon's big cliff is passed, the sandstone again alone makes the ledge and is already very thick, with continuous outcrop up to the big ledge of figure 15. Here again are complicated relations on this steep hill-front, with several strips of the sandstone but most of them badly shattered and traceable only by their debris. The sandstone picks up thinly just north of the Kaaters kill, fails before the thinnest appearance of the Rondout (waterlime) in a small waterfall over a half mile north, then the rock hides to the Cats kill in Austin's glen (figure 58). A thousand feet northeast of the last, the basal contact is again exposed in a small digging by the road under the cliff below the cottages. The beds show near the top of the Austin millroad and in a small quarry just east towards route 23 and poorly in the cut on that highway by the Salisbury House, their last appearance.

[a] Logie's stratigraphic results have been embodied in a pink-print chart sent out to fellow workers. From this and from personal correspondence have been obtained the data accredited to him in these pages. Mr Logie has traced these Silurian beds in detail clear across the State from Lower Canada to New Jersey, making a most important original contribution.

Figure 15 Rondout (Fuyk) sandstone at type locality on West ridge of the Fuyk, west of Catskill, showing the main ledge in the upper (fifth) slice of the imbricated structure. Height of this face more than 10 feet, the sands here replacing all of the Rondout that is present. Note offsetting of cliff on joint faces, and evident but unequal solubility. Looking west of south. Photo: September 1936, E. J. Stein.

Figure 16 Eagle cliff, Austin's glen. Synclinal outlier of Silurian and Devonian limestones (Rondout, Manlius, Coeymans and Kalkberg), Manlius making vertical part of cliff, its talus largely concealing the Rondout. The Cats kill, with island, and old railway grade in foreground. Looking south-southwest. Photo: April 1938, W. J. Schoonmaker.

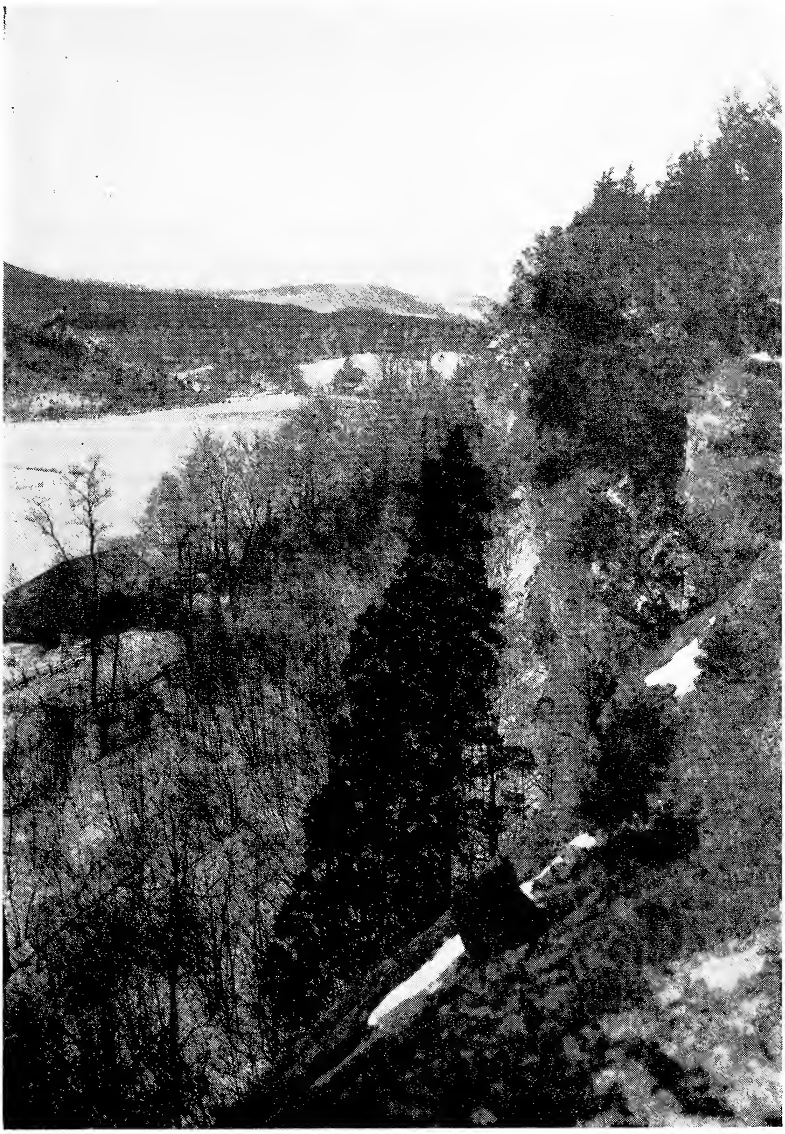

Figure 17 The Fuyk valley, west of Catskill, viewed from east rim. Cliff is chiefly Manlius limestone, capped by Coeymans and Kalkberg limestones on which the camera stands. Note long talus slope (covering Rondout), clay-filled valley below (Lake Albany level), the distant Mt Potick peaks of the Hooge Berg range (Mount Marion beds) and the nearer wooded ranges of the Kalk berg, of which this ridge is an eastward offset across an eroded anticline (see map). Looking about north. Photo: (winter), R. W. Jones.

Figure 18 Laminated or platten limestones in the lower part of the Manlius at old Cornell "black marble" quarry on northwest side of Quarry hill, Catskill. Note cross-bedding in upper right (compare Brigham's Geology, figure 95), nodular nature of middle right and good major and minor jointing. A "clinkstone." Looking southeast. Photo: April 1923, W. Irving Steele.

Figure 19 Manlius limestones upturned along Rip Van Winkle trail (23-A) just out of Catskill, showing high west dip into the Quarry Hill syncline and slickensided bedding-planes where the layers slipped upon each other in the folding. Doctor Ruedemann indicates a larger fault-plane, not following the bedding, which repeats the lower 10 feet of strata. Looking north (toward quarry of figures 21, 22). Photo: April 1938, W. J. Schoonmaker.

2 MANLIUS (OLNEY) LIMESTONE

The cliffs of the Manlius,[1] formerly called the "Tentaculite"[2] limestone, are dominating features along the front scarp of the Kalk berg wherever these beds approach horizontality and sometimes where they are vertically uptilted. Master-joints often control these cliffs for many rods giving a sheerness of face that defies ascent. The weathered ledges, particularly of the "ribbon" layers, are whiter than those of the overlying limestones, but internally the rock is much darker than those, being very dark blue, fine-grained and dense, breaking with a conchoidal fracture under the hammer. Its fresh color has gained for it locally the name "black marble." Natural joint fragments retain their angles well, indicating resistance to solution in rain water, but the purity of the rock is better demonstrated by its solubility in underground waters, giving rise to extensive systems of caverns.

The Manlius limestone (figures 12, 13, 16-21) is here about fifty feet thick. It consists of some ten recognizable strata, of several contrasting kinds in alternation. The fine lamination of the "ribbon-banded" layers is often accompanied by a columnar jointing due to superposed mud cracks, dividing such beds into hexagonal or polygonal prisms from three to ten or more inches in diameter in a fashion suggestive of a cooled lava sheet. Such a structure is almost unknown elsewhere in limestones (see Kindle, 1914; Branson and Tarr, 1928; Roy, 1929)[3] and only in such thinly banded deposits of fine lime-mud, exposed to the sun and air at ebb tides during deposition. The lowest of these beds weathers to "paper shale," showing well the sun cracks along highway 23-A (figure 19) just beyond the crusher-quarry, is about 4 feet thick and may be traced clear across our area and on to Rondout. Around Catskill a ribboned and columnar bed up to 10 feet thick lies in the middle of the Olney and is the most conspicuous of such layers. Another but thin one occurs near the top (figure 21), again all the way to Rondout where it is thicker.

Very different in aspect are the "Stromatopora beds," of which there are from one to three in each section. They appear rough and knotty from the abundance of small heads of these coral-like organisms[4] and are lighter colored internally and slightly more grainy than the usual Manlius beds, thus more like the succeeding Coeymans. Here the main bed lies above the middle of the Olney, just above the main columnar stratum and is massive with a thickness usually of 10 feet, the fossils mostly of the size of apples. A thinner bed commonly occurs at or near the top of the formation and one of about six feet thickness in the lower part, two or three feet above

the paper shales, often dividing into layerlets a few inches thick. At the top of this lower bed, especially on the old mill-road to Austin's glen, is a zone of huge heads (figure 20) from a foot to two feet or more in diameter, some of which are upside down.

These organic reefs eventually tail off laterally into the normal hard blue dense Manlius limestones, varying from thin-bedded to fairly heavy and massive, or even into the ribbon-banded beds. A conspicuous phase of these layers in the old "black marble" quarry on the Quarry hill is a 4-foot zone of somewhat cross-bedded flag-stone-like layerlets, very smooth and even (figure 18; illustrated also in figure 95 of Brigham's Textbook of Geology, 1901 edition).

Characteristic of the talus slopes of the Manlius is the jingling sound emitted by the fragments when disturbed under foot. They rattle down like bits of china or glassware, whence the name "clink-stone." Their mode of fracture is also like glass, but not always so brittle; indeed, the heavier layers are often fairly tough. The dense and rather tough nature of the rock has made it favorable for crushing and screening, for track ballast and "gravel," and as it also packs and binds well under the roller or traffic, it has been used extensively for road metal. Crushers using the Manlius have been operated west of Catskill ("Turtle Pond" quarry at Blivenville, figures 21, 22), at Saugerties (Canoe Hill, figure 67) and Glasco (Schoentag's).

Recently, one of the cement companies has attempted the use of the Manlius for Portland cement, in order to get a whiter product than the Becraft gives.

The Manlius fossils are small but pretty, though few in kinds, and cover certain layers abundantly. The species include:

1 the pteropod, *Tentaculites gyracanthus*;[5]

2 the brachiopods, *Spirifer vanuxemi,* and *Brachyprion varistriatum;*

3 the ostracods, *Leperditia alta, Kloedenia notata, Kloedenella trisulcata;*

4 the pelecypod, *Leiopteria aviculoidea;*

5 the gastropods, *Holopea(?) elongata, H. antiqua, Straparollus sinuatus;*

6 the worm tube, *Spirorbis laxus;*

7 the crinoid, *Lasiocrinus scoparius;* also unnamable crinoid stems;

8 the stromatoporoids, *Syringostroma, Stromatopora,* and others;

9 a cephalopod, *"Cyrtoceras" subrectum;*

10 the bryozoan, *Monotrypella(?) arbuscula.*

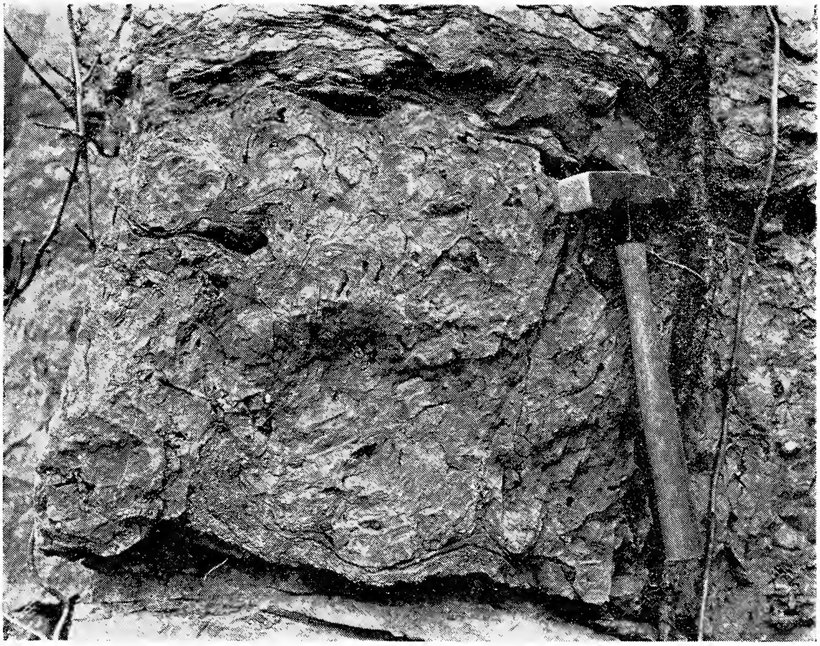

Figure 20 "Stromatopora" in lower Manlius, broken across on a cross-joint so as to expose the structure, which continues to right of hammer (12 inches). Note nodular, and partly shaly, character of inclosing bed, and fragmental filling of voids on lower left. In place in ledge under talus of Manlius cliff on old Austin millroad entering Austin's glen, Jefferson Heights. This bed carrying the big "heads" is down near road grade for many rods. Looking north-northwest. Photo: April 1938, W. J. Schoonmaker.

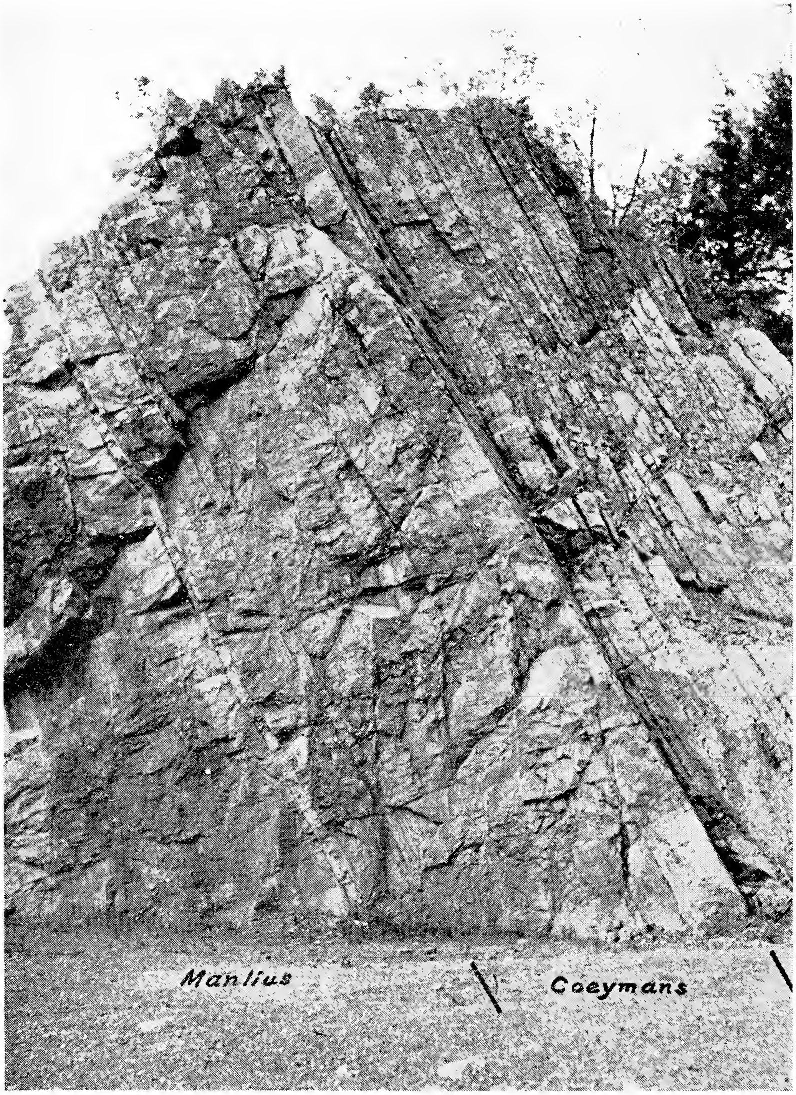

Figure 21 Upturned limestones at south end of Turtle Pond quarry, on Rip Van Winkle trail just west of Catskill. Locality of Kay's measured section (International Congress Guidebook 9A: pages 13-14). Note sharp line between Coeymans and Kalkberg (of old "Lower Pentamerus") but difficult visual separation between Manlius and Coeymans due to reworking and bonding on a disconformity. Looking west of south. Photo: May 1938, W. Storrs Cole.

Supplementary Notes

[1] The original Manlius "waterlime group" in its typical region around Syracuse, N. Y., has been subdivided by later workers into four or more members, of which only the lowest, or Olney limestone, extends into eastern New York according to Mr Logie's tracing (see note 1 under previous subhead). It would be more precise, therefore, to refer to our rock by the name Olney, but it will be difficult to displace the long familiar use of Manlius, and as no other Manlius member is present no confusion will arise.

[2] This name, derived from the abundance of the little pteropod shell, *Tentaculites gyracanthus,* originally supposed to be a sea-urchin spine, is the one used by James Hall in describing the fossils of this formation in our area. Actually, the Tentaculite zone is comprised in the lower half of the Olney, as Logie's chart shows. Southward, the species ranges down into the Rosendale just above the "Wilbur" at Rondout (see Van Ingen and Clark 1903, page 1183).

[3] The outstanding and long familiar occurrence of this phenomenon in the Catskill-Kingston region seems to have been overlooked by these later writers (see Van Ingen and Clark 1903, page 1185 and plate 6). Similar structure is reported by White (1882, p. 77, 144-45, 282) in the Bossardville limestone of northeastern Pennsylvania, strikingly like our Manlius but older than the Rondout. (See also Chadwick 1940.)

[4] The stromatoporoids have been referred variously to the sponges, hydrozoan corals and calcareous algae. Our Manlius forms are poorly preserved in their minute details and have not been studied and described. From cognate formations in the United States and Canada about 30 forms have been named, and of these Marshall Kay (see Chadwick and Kay 1933, page 14) thinks that *Syringostroma barretti* is our most common species, though originally described from the "Lower Pentamerus" (Coeymans) limestone of the Devonian. (See G. H. Girty 1897, p. 296.)

[5] *Tentaculites* is thought by some to be an annelid (worm) tube.

3 COEYMANS LIMESTONE

In the old terminology the "lower Pentamerus limestone" succeeded upon the "Tentaculite" and was followed by the "Catskill or Delthyris shaly limestone." When geographic names (see Clarke and Schuchert, 1899; Clarke, 1900, 1903g)[1] supplanted these old ones, Coeymans and New Scotland townships, both in Albany county to north of our area, were selected for the beds mentioned. But the exact limitations of these strata were nowhere defined with the precision demanded in modern stratigraphy. Hence it came about that both at Catskill and in the Helderberg mountains of Albany county some 50 feet of limestones[2] were looked upon as "lower Pentamerus" (or "Coeymans") by various writers.

A tracing of the layers between these two points has shown, however, that only the lower 15 feet, or less, of the reported 50 at Catskill (figures 16, 17, 21, 22, 67) correspond in lithology and fossils to the 50 feet in the Helderbergs that constituted there the original "Lower Pentamerus," beneath the "Shaly." Since no type section nor precise description of the Coeymans has been given, but that name merely substituted for the old one, and since by lithology and by subsequent description (see Hall, 1859)[3] of its fauna the

New Scotland clearly reaches down to the top of the beds just mentioned, at which point there is a sharp stratigraphic and faunal and lithic break at Catskill, it became necessary to limit the Coeymans to the 15 feet (or less) of such limestone in our area (figure 21). The overlying beds once included in the "Lower Pentamerus" are here referred to the Kalkberg member of the New Scotland, as defined in the next section.

At some points the Coeymans and Manlius form one cliff (figures 16, 17). At others the Coeymans retreats behind the main cliff of Manlius or forms a second and separate ledge. It is easily distinguished from the Manlius by its light color, bluish or sometimes pinkish, and its coarse granular texture, aided by the presence of the smooth, nutshell-like brachiopod *Gypidula coeymanensis* (formerly but erroneously called *Pentamerus galeatus*) and the larger crinoid stems (referable to *Melocrinus* and perhaps also *Lepocrinites*). The beds are massive and knotty, breaking down into irregular hunks.

In the stone crushers the Coeymans goes into the mill with the Manlius and while it is more crumbling its small bulk of admixture does not seriously affect the quality of the product. It is more silicious and a bit more magnesian than the Manlius but with less clay content. The silica present makes itself evident in the tendency to flinty alteration of the shells and crinoid stems, whereas the fossils in the Manlius are calcified rather than silicified.

While the discrimination of the Coeymans from the Kalkberg is an important one, the former could not, because of its thinness, be mapped separately from the latter formation.

The Coeymans fossils are usually few including:

1 the brachiopods, *Gypidula* (*Sieberella*) *coeymanensis, Atrypa reticularis* and *Uncinulus mutabilis;* (*Brachyprion varistriatum,* supposed to range up from the Manlius into the basal two feet of the Coeymans, appears to occur only in slabs of Manlius worked up into the Coeymans base);

2 the honeycomb coral, *Favosites helderbergiae;*

3 the pelecypod, *Actinopteria obliquata;*

4 stems of the crinoid *Melocrinus* and perhaps other genera;

5 the trilobites, *Odontochile micrurus* and *Proetus protuberans.*

Supplementary Notes

[1] The Delthyris limestone generally but not originally included upward to the Oriskany base, thus comprising the Becraft and perhaps the Alsen (see W. W. Mather 1843, p. 325. 343-45, 352). James Hall (1843, p. 144) protested: "The name of Catskill Shaly Limestone, which has been proposed on account of its great development on the Catskill creek, is found to be objectionable, as it at once carries the mind to the Catskill mountains, a very different group of rocks, thus tending to propagate a false impression." But the name Catskill

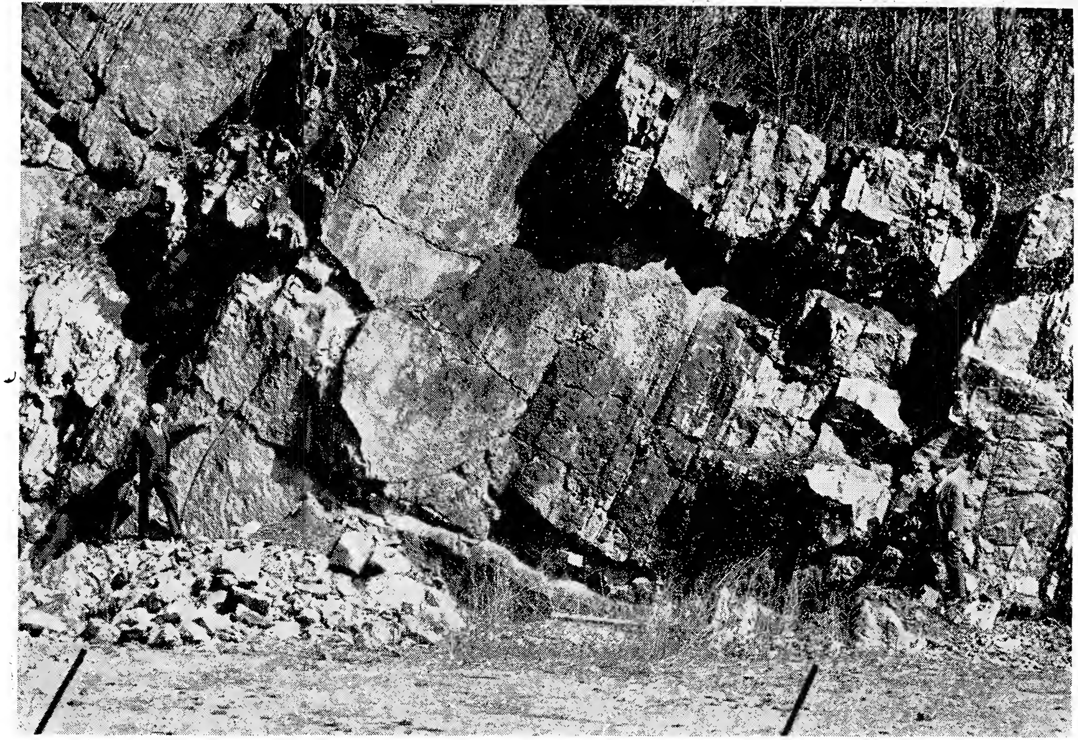

Figure 22 North end of same quarry as figure 21, showing full thickness of Kalkberg limestone between Doctor Ruedemann's hand, right, on sharp Coeymans contact and Chadwick's hand on less evident contact with Catskill shaly limestone. Looking north-northeast. Photo: April 1938, W. J. Schoonmaker.

Figure 23 Lengthwise view of Kalkberg limestone crossing the Cats kill at type exposure in Austin's glen, Jefferson Heights, showing the black chert seams (lower left) that have given the name "Coffin Rocks" to this locality. Note west dip flattening to right into the syncline, and white top of Coeymans limestone uncovered on left; also control of the stream course by parallel master joints (steps in falls). Eagle cliff (figure 16) in distance. Looking west of south. Photo: August 1931, Ashley Robey.

is much more appropriate to the exposures on the Cats kill than it is to those of the misnamed mountains (the Katsberg), to those who know the history of these names in the early days. And the name Catskill shaly limestone remained in the literature as late as 1905 (Clarke, Mus. Bul. 80, p. 5). Because of its correct downward limitation in Austin's glen, we find it convenient to retain it for the typical shaly portion, in the sense in which Delthyris limestone was used by E. Emmons 1846, p. 167-68.

[2] W. M. Davis 1882, p. 23, says "about eighty feet" which includes very exactly all the thick-bedded strata next above the Manlius. Mather's limitation (1843, p. 325, 326, 346-47) gives a thickness of only 41½ feet at the Turtle Pond quarry for the combined Coeymans and Kalkberg, but his "fifty feet" (page 347) are based on the Helderbergs though his description is for Catskill. The name Coeymans is Dutch, for an early settler, and is pronounced coo-ee-mans or kweemans. Geographically it lies intermediate between Catskill and New Scotland.

[3] Hall states plainly (p. 259) that *"Pentamerus galeatus"* (now *Gypidula coeymanensis*) ranges above the Coeymans, saying: "The more perfect specimens are obtained from the Shaly limestone above the Pentamerus limestone." He clearly understood the true stratigraphic relations.

4 KALKBERG LIMESTONE

The reasons for the separation of the Kalkberg (figures 21-25, 67) from the Coeymans have been partly stated under the account of the latter and will be discussed more fully in the next section. The equivalent of these beds in the Helderbergs is a series of thin but highly fossiliferous limestones extensively interbedded with shales like those of the overlying shaly limestone (Catskill member), together with which they constitute the New Scotland limestone, the Delthyris limestone of Emmons 1846 and Hall 1859; but the distinction is easy to make. The silicified fossils that weather loose in great numbers at the Indian Ladder park in the Helderbergs are identical with those that similarly weather out of the hard limestones at Catskill. All of these forms were described by Hall as coming from the Shaly limestone, at both localities, so that we are in full accord with him in separating the Kalkberg from the Coeymans at Catskill. The type locality chosen for the Kalkberg formation or member is where these beds cross the Cats kill at and below the "coffin rocks" (or "flat rocks") in Austin's glen (figures 1, 23). At this point the creek is emerging from the Kalk Berg range. The locality has been a favorite one for collectors since the days of Amos Eaton (Chadwick, 1908).

From 25 to 35 feet in thickness of beds are referred to the Kalkberg at different points in our area (figure 22). These are hard and heavy impure limestones, darker, less granular and more fossiliferous than the Coeymans and carrying (figure 23) seams of black chert (hornstone flint). These seams begin close above its basal contact with the Coeymans, which is a marked bedding-plane, and continue to recur through the first ten or fifteen feet, above which they break up into scattered flints and become almost lacking at the top. Unlike the Coeymans, the Kalkberg gathers a rusty clay crust

several millimeters thick upon its weathered surfaces, from which the prettily silicified fossils slowly loosen and accumulate in the talus or in the residual earth in the seams and joints. Sometimes the Kalkberg caps the Coeymans-Manlius cliffs (figure 17), but when tilted it usually forms its own lesser cliff behind that of the Coeymans. Strong jointing and ready solubility along joints and seams give rise to the rectangular blocks so strikingly shown in the "coffin rocks" (figure 23) and elsewhere, besides resulting in the entrances to numerous caverns (figure 24) that extend down, often into the Manlius.

In its upper half the Kalkberg grows more impure, argillaceous, tending to grade into the shaly limestone above it, and becomes still more packed with fossils, especially small kinds and bryozoans. The lime tends to segregate into nodules of purer and more fossiliferous nature embedded in a mesh of more argillaceous and silicious stuff, often with a regularity like that of a tennis net. This characteristic is much more marked in the next overlying 35 feet or so of rock which, though still in heavy beds, weathers so shaly and weak that it has been grouped with the thinner bedded shaly limestones above. It is a feature also of the chert-seamed Alsen limestone higher up, which the Kalkberg thus may often deceptively resemble when it develops similar buffy tones on weathering. This resemblance to the Alsen increases northward and is most marked in the vicinity of the Leeds turnpike (highway 23) at the north edge of the map.

The Kalkberg limestone also goes into the crushers along with the lower beds.

The fairly profuse fauna of the Kalkberg includes hereabouts:

1 the brachiopods, *Bilobites varicus, Dalmanella perelegans, D. concinna, D. planoconvexa, D. quadrans,* and *D. subcarinata, Rhipidomella oblata, Leptaena rhomboidalis, Brachyprion aratum, Strophonella leavenworthana, Anastrophia verneuili, Gypidula* [*Sieberella*] *coeymanensis, Camarotoechia transversa?, Uncinulus nucleolatus, U. pyramidatus,* and *U. abruptus, Eatonia medialis,* and *E. singularis, Atrypina imbricata, Atrypa reticularis, Cyrtina dalmani, Spirifer macropleura,* and *S. cyclopterus, Delthyris perlamellosa, Nucleospira ventricosa, Coelospira concava, Rhynchospira formosa* and *Rh. globosa, Trematospira perforata, Meristella laevis,* and *M. arcuata;*

2 the corals, *Favosites helderbergiae,* and *F. conicus, Enterolasma strictum* and *Caninia roemeri;*

3 stems of the crinoids, *Mariacrinus stoloniferus, Melocrinus* sp., *Cordylocrinus plumosus,* and *Brachyocrinus* (*Myelodactylus*) *nodosarius;*

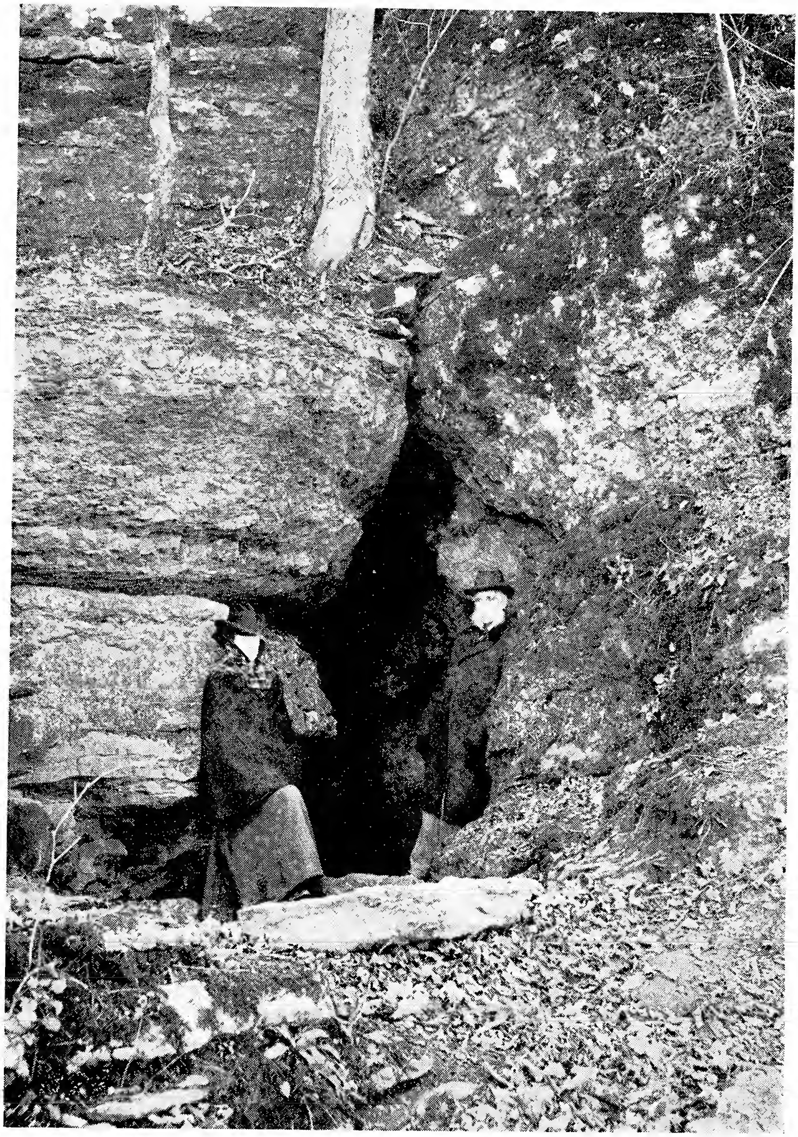

Figure 24 Kalkberg limestone at Austin's cave, west of Salisbury Hotel, Jefferson Heights, in high cliff overlooking the Cats kill as it emerges from Austin's glen. Water enters over (and through) ledge above, escapes far below in Manlius limestone on Austin millroad. Looking east. Photo: November 1902, G. H. C.

Figure 25 Catskill shaly limestone in its type exposure on the Cats kill at mouth of main gorge of Austin's glen, Catskill. Creek escapes diagonally across lower limestones as they roll up on east side of syncline (see figures 1, 23). Manlius (and Coeymans) in foreground; Kalkberg beyond water, to line of talus; then heavy-bedded lower Catskill with more shaly above; Becraft caps knob at left. Looking south of west. Photo: April 1938, W. J. Schoonmaker.

4 the trilobites, *Phacops logani, Goldius pompilius* and *Odontochile* sp.;

5 the sponge, *Hindia inornata;*

6 numerous bryozoans of the genera *Trematopora, Hallopora, Callotrypa, Chilotrypa, Fistulipora, Polypora, Monotrypa* etc.

5 CATSKILL SHALY LIMESTONE

Of the muds of the ancient seas none are more prolific in our region than the "Delthyris shaly limestone" of the old reports, named from its carrying the large *Delthyris* (now *Spirifer*) *macropleura*[1] and other spirifers. It was this rock (figures 1, 12, 22, 25, 26, 69, 78) that Professors Clarke and Schuchert renamed the New Scotland limestone as it is developed in the Helderberg mountains. But it should be noted that the earliest geographic name of this formation was the alternative one of "Catskill shaly," derived from its exposures on that creek in Austin's glen (figures 25, 26). Yet, as we have pointed out, these two names are not strictly synonymous, since the Catskill did not include the Kalkberg member of the New Scotland, but is itself the complementary member of the New Scotland, the Kalkberg being shaly on the Helderbergs but massively bedded at Catskill. Inasmuch as no other name presents itself for this higher member of the New Scotland formation, that of Catskill is here employed as of the greatest appropriateness and of long standing in the literature though in a dual sense.[2]

The highly fossiliferous shaly-looking slabs of the Catskill limestone are strewn about or heaped into stone fences throughout its line of outcrop, veritable treasure houses for the collector. The fossils are, however, in general only impressions or natural molds with the shelly substance dissolved away. Such original calcareous portions of the shells as remain are strikingly white against the dun matrix; there are also black fragments of trilobites or lingulas and similar. The weathered color of the slabs varies from gray to "coffee and cream," the whole effect dull and unattractive, becoming dark and forbidding in the rugged ledges. Fresh cuttings show a dark blue, lusterless and often massively bedded rock, appearing as a true limestone. The total thickness is not easy to determine with accuracy because of faulting or minor crumpling at the places best suited for measurement; it is thought to be approximately 120 feet.

The behavior of the "shaly" limestone under the weather is not the same at different points or at least at different levels within it. In general there are rapid alternations of more shaly and more resistant beds. Some of the latter are like thin recurrences of the

Kalkberg, though the silicified fossils (including many bryozoa) in these layers seem more delicate than in that rock while the chert is lighter in color and less abundant. In the thick-bedded but weak rocks of the basal 35 feet these fossils occur best preserved in the deeply weathered pittings the size of one's fist that result from the solution of the purer limy nodules mentioned under the preceding section on the Kalkberg member. In the north part of the quadrangle these lower beds produce usually a hollow between the Catskill and the Kalkberg ledges; a similar depression often lies between the Catskill and the superjacent Becraft limestone. The middle portion of the Catskill shaly limestone is therefore the more resistant, but still it is less so than the heavy limestones above and below. Yet at points where the strata are on edge the normally weaker shaly Catskill limestone often rises above these buttressing formations to form the backbone of the ridge, whereas the Kalkberg and Becraft subside into subordinate altitudes on the flanks. That this anomaly may result from greater induration of the shaly beds by lateral compression exerted at right angles to the bedding of the upturned layers is suggested by the seeming reduction in thickness of the Catskill limestone at such places.

Under other circumstances of compression, especially in the drag-zones of the overthrust sheets, these shaly limestones have proved quite incompetent and are crumpled, sometimes most intricately. Distortion or fracturing of the fossils is then a frequent consequence. In places, a closely spaced shearing-cleavage obscures the true bedding.

In composition the Catskill shaly is just about half limestone, analyses usually ranging from 30 per cent to 70 per cent of calcium carbonate. The remainder is mostly silica, with some alumina and about 3 per cent of iron oxide. Thus the rock is not suitable for cement, as it might be if clay replaced the silica and iron content. Except for the basal part it is avoided at the stone crushers, so that its chief economic use has been for stone fences and for cheap foundations.

The fossils of the Catskill member of the New Scotland include in part:

1 the gastropods, *Platyceras ventricosum, P. gebhardi, P. trilobatum, P. intermedium?, P. platystomum alveatum, P. retrorsum, P. calantica, P.* (*Orthonychia*) *lamellosum, P. spirale* etc., and *Diaphorostoma ventricosum;*

2 the brachiopods, *Spirifer macropleura, Schellwienella woolworthana, Meristella arcuata, Delthyris perlamellosa, Eatonia medialis, Strophonella headleyana, Leptostrophia becki, Leptaena*

Figure 26 Overthrust fault, with marked "drag," on former Catskill Mountain railway at reverse curve in Austin's glen, Jefferson Heights (north bank of the Cats kill, see figure 1). Massive Becraft limestone at left, dipping east (right); fault surface diagonally up middle from right to left; arching (dragged), strongly cleaved New Scotland (Catskill) shaly limestone on right, also dipping east, belongs below the Becraft. Looking north-northeast along the strike. Photo: August 1912, H. L. Fairchild.

Figure 27 Becraft limestone quarry of George W. Holdridge on Quarry hill, west of Catskill, from which many fine public buildings have been constructed. Massive bed at the top (rear) is known to the trades as "Catskill shell marble." Looking west. Photo supplied by Mr Holdridge.

rhomboidalis, Rhipidomella tubulostriata, Orthostrophia strophomenoides, Pholidops ovata, Lingula rectilatera;

3 the trilobites, *Phacops logani, Odontochile pleuroptyx, Ceratocephala tuberculata;*

4 the pelecypods, *Aviculopecten tenuilamellatus, Actinopteria communis,* and *A. textilis, Pterinea halli;*

5 the cephalopod, *Orthoceras rude;*

6 the pteropod, *Tentaculites elongatus;*

7 the sponges, *Hindia inornata, Receptaculites infundibuliformis* and *Aulacopina(?)* sp.;

8 the crinoids, *Edriocrinus pocilliformis, Aspidocrinus callosus,* and various unidentified stems, the joints of which are numerous in the upper beds;

9 various bryozoans, of which the following are definitely reported from our area, *Fistulipora maculosa, Monotrypella? (Eridotrypa?) densa, Callotrypa macropora, C. striata, C. unispina, Polypora obliqua, Stictopora? granatula;* three others whose horizon is not given may be from the Kalkberg rather than the Catskill, namely *Unitrypa praecursor, Polypora arta, Ptilodictya nebulosa.*

Supplementary Notes

[1] This species recurs in the Alsen limestone, though sparingly, and is thus not so diagnostic of the New Scotland as was once supposed. See note 1 under the Coeymans limestone, for the history of the formation names. Lardner Vanuxem (1842, p. 120) in proposing the name Catskill shaly limestone to include, as he says, the Delthyris shaly limestone and Scutella limestone of the annual reports, explains: "The present name of this rock is taken from Catskill creek, near the town of Madison, Greene county, by the side of the railroad, where for a long distance it is exposed to great advantage for examination. The name is objectionable, but it is no easy matter to find one in the State which will be less so." Madison is now Leeds, the railway a memory.

[2] The name Catskill has become ingrained in geologic literature for the red beds of our mountains, where its correct limitations remain a matter of controversy. Because of the fallacious shift of the name of the creek to these mountains, as previously pointed out, it is unfortunate that it ever gained such currency among geologists. Since the red beds are now subdivisible in their type area, opportunity has been taken to employ herein the more appropriate Dutch and Amerindian terms, Katsberg and Onteora, their designations for the uplands, and to retain Catskill for the limestone whose description precedes that of the red beds in Vanuxem's report, the original publication of the name in both senses.

6 BECRAFT LIMESTONE

Most important economically of our limestones is the "shell marble" of local parlance, the "Scutella or Encrinal limestone" of the old reports,[1] renamed from Becraft's "Mountain" in the rear of the city of Hudson, an interesting outlier of Silurian and Devonian rocks off the northeast corner of our map area. There as on the west side of the river it is the main material for the manufacture of Portland

cement. Analyses of the fresh rock run as high as 98 per cent of calcium carbonate, 90 per cent being a general average.

The Becraft (figures 26-29, 65, 68, 69) is a beautiful and durable building stone, as attested by some of the best public buildings in Catskill and elsewhere. It was used also for cyclopean blocks in the construction of the concrete anchors for one of the East River bridges in New York City. It takes a good polish and trims easily to any desired ashlar, but loses its polish too easily on exposure to be useful for monumental work.

The massive but much dissolved ledges of the Becraft limestone are the most conspicuous of any between the Manlius and the Onondaga. Open joints and seams characterize its outcrop, proof of its purity and solubility but making treacherous footing especially after the leaves fall. Yet caverns of any extent are not frequent in it.

Though, like our Helderbergian formations in general, usually somewhat darkened on the weathered surface, the rock is normally very light colored within. It crumbles to a white, sugary powder under the hammer and gives but little sound when struck. In grain it is coarsest of our strata, composed mostly of crinoidal fragments mingled with rather small brachiopods of few kinds and often with many of the larger watchglass-shaped objects formerly called "Scutella" (being mistaken for a genus of sand-dollars), now known as *Aspidocrinus scutelliformis* and considered to be crinoid anchor-plates. These have recrystallized into cleavable calcite of creamy white color, making them conspicuous against the light gray or pinkish tints that predominate in the matrix, to which some soft yellowish tones add warmth on exposure. The general effect is not cold, but fleshlike, enlivened by an abundance of calcite cleavage of all the organic fragments, recrystallized. It is this recrystallization that entitles the Becraft to pass commercially as a marble, though it is not a "metamorphic" rock in the limited sense.

Chert is unusual in the Becraft, yet it has been discovered at a few localities and at different levels in the formation, very sparingly, especially a thin seam at the very base. Exceptionally, the fossils are silicified.

The lower part of the 60 feet of Becraft on our area is thinner bedded (figure 27) than the upper massive stratum and carries seams or partings of bright green to black flinty shale, from one-half to four inches thick. These shale seams sometimes stand out on the weathered joint faces, being evidently less soluble than the limestone. Frequently they are packed with *Atrypa reticularis* and other fossils.

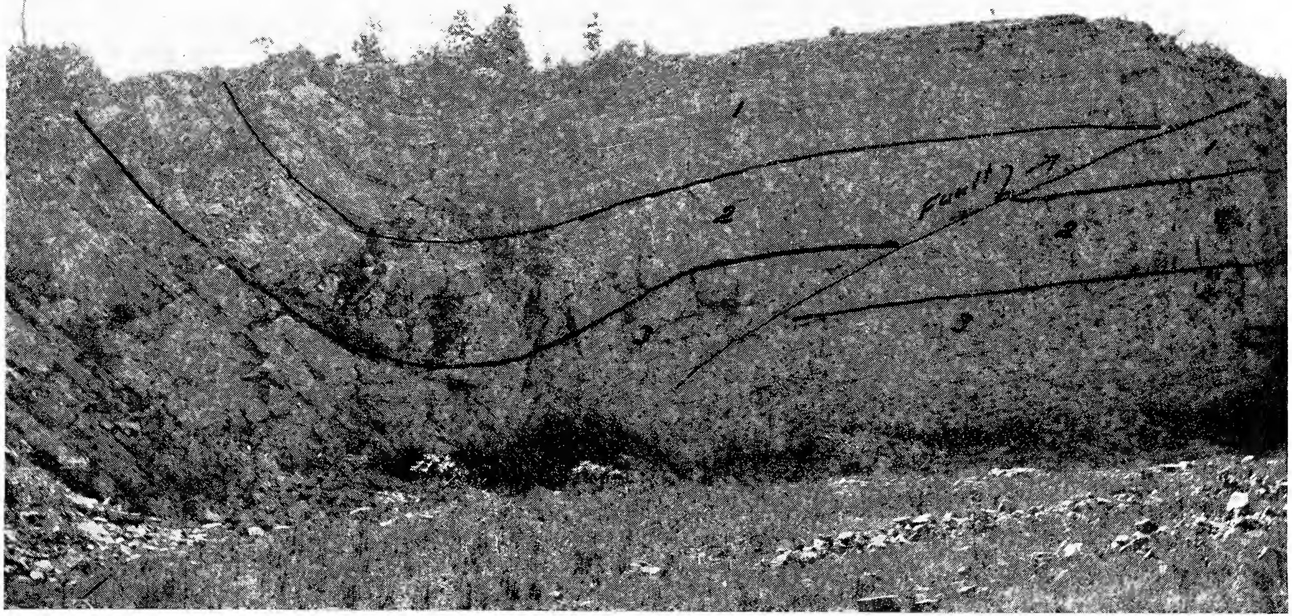

Figure 28 Becraft limestone overlain by Alsen limestone in south end of south Alsen quarry at Alsen. Characteristically unsymmetrical syncline with full thickness of both limestones at type locality of the Alsen. Height of face is 90 feet. Looking south. Photo and retouching by Robert W. Jones.

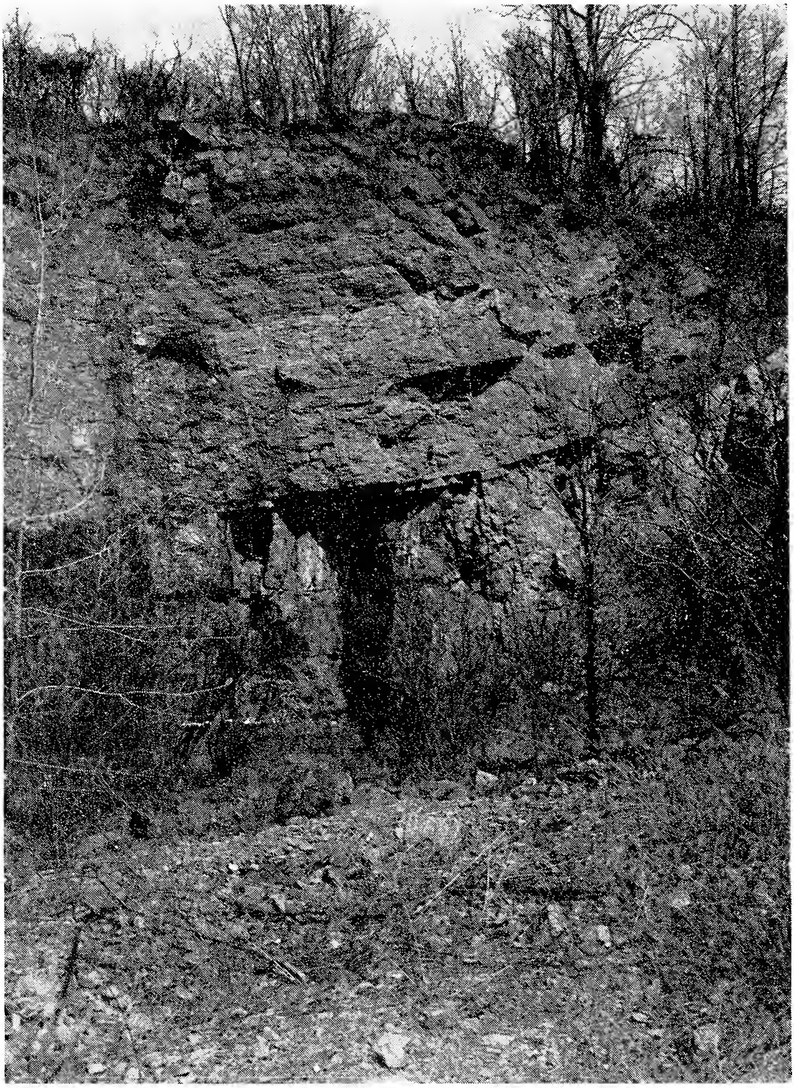

Figure 29 Alsen limestone of type exposure in middle Alsen quarry, Alsen, now property of the Lehigh. North wall of quarry, showing massive upper Becraft limestone up to the overhang, full thickness of Alsen, including banded "yellow" beds at its top, capped by about 15 feet of Glenerie cherts with shales. Looking north. Photo: April 1938, W. J. Schoonmaker.

They help to reduce the lime content of these lower beds to about 80 per cent of calcium carbonate, average analysis.

These shale seams increase and the beds grow thinner downward, so that the transition from the New Scotland (Catskill) below is not very sharp, especially since the summit of the latter becomes crinoidal and carries increasing proportions of thin, but blue and resonant, limestone bands. When attentively examined there is nevertheless no trouble in drawing an exact line.

The fossils of the Becraft limestone are chiefly:

1 the crinoid anchor-plate, *Aspidocrinus scutelliformis,* and stems of *Clonocrinus(?) macropetalus, Cordylocrinus parvus* etc.;

2 the brachiopods, *Spirifer concinnus, Atrypa reticularis, Uncinulus nobilis* and *U. campbellanus, Meristella princeps, Orbiculoidea discus;*

3 the (rare) gastropods, *Strophostylus fitchi, Straparollus decollatus, Salpingostoma profundum, Phanerotrema labrosum;*

4 orthocerate cephalopods, rare and poorly preserved;

5 fistuliporoid and fenestelloid bryozoans, not common.

Supplementary Note

[1] The "limestones of Becraft's mountain" was the first name applied to the Helderbergian rocks in the early annual reports (W. W. Mather's second report, 1838, p. 166). The first subdivision of these was into Pentamerus limestone, shale and Sparry limestone two years later (Mather, 1840, p. 237), while farther on in the same volume the names Delthyris shaly limestone and Scutella limestone were given for the last two (Vanuxem 1840, p. 377), and Mather adopted these names in the following year (fifth report on our district). In 1842 Ebenezer Emmons (p. 429) substituted Encrinal limestone for Scutella, but misplaced it above the Oriskany, while Vanuxem (1842, p. 120) merged both the Delthyris and the Scutella in his Catskill shaly limestone and Mather (1843, p. 343) adopted the same grouping but preferred the name Delthyris for the combination. Hall, however, (1843, p. 145) continued to keep the Encrinal (Scutella) distinct from the Delthyris and added an Upper Pentamerus limestone above the former. Thus the present Becraft, or "upper limestone of Becraft mountain," has been known as Sparry, Scutella, Encrinal, Catskill in part, Delthyris in part, and Upper Pentamerus (at least in part). (See Darton 1894, p. 398, 406, pl. I; Hall 1893, p. 11).

7 ALSEN LIMESTONE

The Alsen succeeds the Becraft much in the same way that the Kalkberg follows the Coeymans, with incoming of black chert seams and a general reduction in purity and in size of grain. Its resemblance to the Kalkberg limestone has already been remarked. Seldom, however, does it form such cliffs as does that limestone. Usually it either caps the Becraft ledges or retires behind them into obscurity. Seldom, too, does its real thickness of 20 feet or more impress one in the natural exposures. The cement quarries reveal it better (figures 28, 29, 65, 68, 69) and they furnish its type locality (see

Grabau, 1919, p. 470). The Alsen was formerly made a basal portion of the Port Ewen formation, into which it tends to grade upward much as the Kalkberg does into Catskill shaly. The character of the fossil remains in the two is also parallel—silicified in the Alsen, as molds in the Port Ewen. They are 45 feet thick at Leeds.

The basal layer is finer grained and more resonant than the Becraft, but still usually of a light flesh color. This color quickly changes in succeeding beds to a blue, becoming still more dense and finer grained toward the top. A subargillaceous meshwork appears, like that in the Kalkberg and especially the basal Catskill but more conspicuous, inclosing the nodules of purer lime. Weathering often brings out much buffy coloring. The fossils are mostly silicified, as in the Kalkberg, and often weather free, but are more apt to be affected by a ring-growth of the silica that destroys the finer surface markings. The almost constant presence of *Spirifer concinnus,* and the frequency of *Monotrypa tabulata* and the large circular apertures of *Platyceras obesum,* are among the best means of distinguishing the Alsen from the Kalkberg in areas of faulting where the succession is obscured.

The calcium carbonate content drops to about 85 per cent in the Alsen, with considerable increase in silica and a little more magnesium. The beds, though less suitable for cement and troublesome in the grinder because of the flint, are not wholly rejected, however.

Because of its former inclusion in either the Becraft or the Port Ewen, or partly in both, the faunal lists of the Alsen became mixed with those until it was specially restudied by the writer. (See Davis, 1883, p. 391; Clarke, 1900, p. 73; Grabau, 1903, p. 1062-67; Van Ingen and Clark, 1903, p. 1192-97; Shimer, 1905, p. 183-84, 262-68; Grabau, 1906, p. 154-57; Chadwick, 1907.) Its separation from the Port Ewen and Becraft serves a useful purpose, but in our area it can not be discriminated on the scale of our map from the Port Ewen and is included in one color with that rock.

The fauna of the Alsen limestone includes:

1 the bryozoans, *Monotrypa tabulata, Fistulipora maculosa* and many other forms;

2 the gastropod, *Platyceras obesum;*

3 the brachiopods, *Rhipidomella oblata, Spirifer concinnus, S. cyclopterus* and *S. macropleura, Atrypa reticularis* (a thickened gerontic form is usual), *Delthyris perlamellosa, Schizophoria multistriata, Schellwienella woolworthana, Leptaena rhomboidalis, Brachyprion schuchertanum, Eatonia peculiaris, Nucleospira ventricosa, Uncinulus nobilis, Trematospira perforata, Rhynchospira globosa?,*

Cyrtina varia, Meristella princeps, Lingula rectilatera, also rarely *Spirifer macropleura;* perhaps *Beachia suessana* of the Oriskany fauna;

4 the corals, *Vermipora serpuloides, Enterolasma strictum, Caninia roemeri, Pleurodictyum lenticulare, Favosites helderbergiae* and *F. conicus;*

5 crinoid stems, especially of *Clonocrinus(?) macropetalus;*

6 the sponge, *Hindia inornata.*

Many of these have come up from the New Scotland, some from the Becraft. Only a few are new.

8 PORT EWEN BEDS

In the Rondout region, south of our area, the Alsen limestone lies at the base of a thick mass, somewhat resembling the New Scotland (Catskill), which passed as "upper or recurrent Shaly" until renamed geographically.[1] Port Ewen village lies just south of Rondout, and the exposures are in the long West Shore railway cut three-fourths of a mile above Port Ewen station. The succession of Becraft, Alsen, Port Ewen around Kingston and Rondout is like that of Coeymans, Kalkberg, Catskill shaly in the lithic changes involved, though there is in general less likelihood of confounding the Port Ewen with the Catskill limestone than the Alsen with the Kalkberg. It is much less fossiliferous than the Catskill shaly.

The 150 feet[2] of Port Ewen that succeed the Alsen around Rondout diminish rapidly northward. As they enter our area from the south they have dropped to a few feet and become more assimilated to the Alsen member. Northward from West Camp they are scarcely noticeable in outcrop. The quarries and road cuttings show, however, that there lingers a thin representative of these beds at most points, darker and more argillaceous than the Alsen, weathering yellower and more banded, lacking chert. From about 15 feet at Alsen (figure 29) the thickness falls to only seven or eight feet where it crosses the Cats kill in the upper part of Austin's glen at the north edge of our map. At several points on the quadrangle, even in the south part, it appears to be wholly absent.

The Port Ewen is less fossiliferous than the Alsen, though there is not much change in the species and, except to recognize the Alsen as a basal phase, the separation is a doubtful one, the lithic change being gradual and the line probably drawn at different levels at different points. The type Port Ewen is lithically rather like the Esopus, and like that rock it contains profuse tubular burrows at certain levels, but it differs essentially in being definitely limestone

of the Helderbergian sea. The fresh color is somber, the weathered surfaces of the higher beds when present are more often gray than buff. Good exposures have been made along the new Palenville-Catskill road (route 23-A) at the extreme summit of the Blivenville hill and at intervals beyond, in which the Alsen lithology extends up to the base of the Glenerie beds and no typical Port Ewen is seen; yet the higher beds lack chert, have fossils as molds, more clay content, darker color, species indicative of the Port Ewen and probably correlate with layers next above the Alsen at Rondout as well as with those assigned to the upper Alsen in Austin's glen (thus accounting for the excessive thickness of 37½ feet of Alsen there). Phosphatic nodules at the top indicate an erosional break between the Port Ewen (respectively Alsen) and the Glenerie. Such nodules occur elsewhere at this horizon, especially on the upper or old stage road south of Schoentag's about 1.8 miles southwest of the Glasco docks as measured on the map, and here they top the small thickness of Alsen limestone with the Port Ewen wholly pinched out.

While the Port Ewen has some affinities with the Oriskany group and shows some faunal gradation, especially from Kingston southwestwardly, its divorce from the Alsen and from the Helderbergian generally does violence to the facts. There is no satisfactory break from the top of the Port Ewen down to the Coeymans base (the hiatus that was postulated by Grabau below the Port Ewen being actually above it), wherefore it seems wisest to retain all these beds in the Helderbergian where they originally resided.

In the northern part of our area, the Port Ewen remnants carry about 75 per cent of calcium carbonate and 15 per cent to 20 per cent of silica. But southward, the lime content must drop even lower than that of the Catskill shaly; no analyses are at hand.

The following list of fossils is based chiefly on collections made in the Rondout region, south of our map, though all the species named may be expected to occur on our quadrangle. These include:

1 the bryozoans, *Monotrypa tabulata* and *Fistulipora ponderosa;*

2 the brachiopods, *Eatonia peculiaris* and *E. medialis, Spirifer cyclopterus,* and *S. concinnus, Rhipidomella oblata, Dalmanella planoconvexa, Leptaena rhomboidalis, Leptostrophia becki, Reticularia modesta, Coelospira concava, Delthyris perlamellosa, Pholidops ovata* and rarely *Spirifer macropleura;*

3 the corals, *Duncanella rudis, Pleurodictyum lenticulare;*

4 the sponge, *Hindia inornata;*

5 the pteropod, *Tentaculites elongatus;*

Figure 30 Glenerie limestone in type exposure at old quarry on east side of route 9-W a quarter mile north of Glenerie Mills, four miles below Saugerties. Shows about 30 feet thickness (the Rev. C. E. Brown gives measure), much of which is packed with silicified fossils here and along highway. Looking northeast. Photo: April 1928, G. H. C.

Figure 31 Glenerie cherts, with interbedded shales, on Rip Van Winkle trail opposite Ellsworth Jones's house, two miles west-southwest of Catskill, (compare figure 29). Note easterly dip into Quarry Hill syncline. Looking north. Photo: October 1927, G. H. C.

6 the pelecypod, *Cypricardinia lamellosa;*

7 the trilobites, *Homalonotus vanuxemi, Phacops logani, Odontochile pleuroptyx, Ceratocephala tuberculata;*

8 "fucoidal markings" or tubular worm burrows.

Supplementary Notes

[1] Overlooked by earlier writers or confused by them with the New Scotland, the "Upper Shaly" was first differentiated by W. M. Davis in 1883 (pages 390-91), a date coinciding with the opening of the West Shore Railroad which has a long cut through these beds on the south side of the Rondout creek. In their great revision of 1899, Clarke and Schuchert called them the Kingston beds, a preoccupied name (in Canada) later changed by Clarke (1903, p. 21) to Port Ewen.

[2] The reported figures (see W. M. Davis 1883, p. 390; N. H. Darton 1894, table opposite p. 396, p. 407, 491, 498, 517; J. M. Clarke 1900, p. 73; Van Ingen and Clark 1903, p. 1194), when the Alsen is deducted, range from 100 to 200 feet in the Rondout region, with the more startling difference of 40 to 180 feet at Whiteport (Darton p. 407, Van Ingen and Clark p. 1195). Some of the divergences are due to faulting and internal mashing at the various exposures. The writer's own field work would indicate that about 100 feet comes nearer the truth from East Kingston southwestward to New Jersey.

9 GLENERIE LIMESTONE AND CHERT

Buff browns are the characteristic weathering colors of the Glenerie Oriskany beds, but the fresh exposures are very blue to nearly black, often fading to a neutral gray where weathering has just begun. These colors are more constant than the rock composition, as that ranges from limestone to solid chert beds, to soft shale and to conglomerates. This variability, together with the thinness, marks the shorewardly onlapping nature of the Glenerie beds and emphasizes the importance of the time-break at their base—a line formerly chosen (and to which we may return) as the base of the Devonian system. Southward, they thicken greatly into limestones (figure 30); northward in the Helderbergs they grade over into two or three feet of sandstone, there correlated with the coarse Oriskany white sandstone of central New York, whose type locality is southwest of Utica. This very thin sandstone layer in the Helderbergs is packed with the characteristic coarse brachiopod shells or their molds[1] and is decidedly flinty, giving glassy surfaces when glaciated. As it comes southward it soon loses any character of sandstone, becoming a chert or cherty limestone (figures 29, 31, 68). Throughout this change it keeps most of the diagnostic brachiopod fossils of the typical Oriskany, the coarse forms that would survive wave buffeting on the beach. But added to these are now smaller species germane to the limestone reefs and ranging up from below, with some new forms, constituting a much more profuse fauna and giving rise to the impression that the Glenerie limestones were older (lower) than the typical Oriskany sandstone.

On the Cats kill below Leeds, just as these strata enter our quadrangle, they roll out flat in the creek bed, exhibiting highly fossiliferous cherty seams with many species that are holdovers from the underlying Helderbergian formations and only subordinate numbers of the typical large Oriskany forms. Nine feet of beds are here referred to the Glenerie, resting on the seven-foot Port Ewen shaly stratum. They pass directly beneath the Esopus shale of the big cliff (Darton, 1894, plate 2 op. p. 402) formed by that rock at the former Leeds Mills, which is so conspicuous from route 23. At low water all contacts and the entire succession from the Alsen to the Esopus and then through the Schoharie to the Onondaga can be studied here, care being taken to recognize some small thrusts in the Glenerie and Esopus. The only equally good exposures of the Glenerie contacts are on the Esopus creek at the Oak Ledges, Saugerties or in the cement quarries.

Southward from Leeds (Austin's glen) the Glenerie beds are much masked under strips of alluvium or swamp as far as Van Luven's lake, though search reveals some natural exposures. The fresh cuttings on the new Palenville-Catskill highway (23-A) have supplied excellent sections (figure 31) and brought to light shaly phases interbedded with and bottoming the cherts, as well as one thin zone of pebbles. Fossils, including some species not yet described, are abundant in these cuts but not easy to collect. A pebble zone occurs also just at the north edge of our quadrangle in the Glenerie beds at the "natural dam" in Austin's glen and one or two such layers in the cement quarries.

Southward from Van Luven's lake the Glenerie assumes a physiographic importance it has not had north of there, capping and protecting the cement limestones (Alsen and Becraft) in the various fault-blocks of the West Camp syncline. It is the "black rock" dreaded by the quarrymen as exceedingly difficult to drill. In the deep railway cut of the Alpha company at the south end of this ridge, the Glenerie is seen to be at least 20 feet thick, nearly all black chert.

But it is from Saugerties southward that the rock takes on its most interesting character through the incoming, at the top, of highly fossiliferous limestone beds. This locality, made famous by the collections of the late Reverend Thomas Cole jr of Saugerties, furnishes our name for the formation, from the old Glenerie white-lead mills on the Esopus creek that still stand unused at Glenerie falls of the map. The type exposure is a small old quarry (figure 30) on the east side of highway (9-W), north of the mill, but the collecting grounds extend north nearly to the bridge leading to Mt Marion[2]

and have furnished a wealth of fossils so beautifully silicified as to rival those well known to paleontologists from the Oriskany of Cumberland, Md. Across the creek is the type Esopus shale (figure 32).

A comparison of the map areas covered by the Glenerie here with its diminishing prominence northward to the Cats kill is instructive. Farther south it thickens more and more, while a small-pebble conglomerate comes in below it, at Rondout, which is still of Oriskany age. The aspect of this Connelly conglomerate is that of a transgressing deposit, an interpretation strengthened by its disappearance northward, along with most of the Port Ewen (from top down), the incoming there of pebbles at higher levels which have become basal Oriskany, and the occurrence of phosphatic nodules beneath the basal contact. The Connelly has not been detected in our map area.

Nowhere within the Catskill quadrangle is there any exposure to which one could apply the name "Oriskany sandstone." Failure of several acute observers to recognize the Oriskanian here was due to this absence of this sandy phase associated with the name in their minds. But the belief that the beds here present are earlier in age than the typical Oriskany because of their large admixture of holdover Helderbergian species seems to lack cogency. (Ulrich and Schuchert 1902, p. 653 have only upper Oriskany in eastern New York.) As pointed out by Doctor Clarke (1900, p. 72) and Professor Shimer (1905, p. 190), the calcareous facies of the rock provides a sufficient explanation of the faunal difference. On the other hand, it is equally true that the presence in both localities of *Spirifer arenosus* and its associates by no means proves that the two rocks are necessarily continuous and contemporaneous deposits. The Oriskany sand is just such a beach deposit as we have in our Rondout at Alsen and like that it must have formed rapidly and be the equivalent of but a few feet of limestone. But *Spirifer arenosus* ranges through 300 feet of beds in Maryland. Until more information is at hand, therefore, it seems best to continue the local designation, Glenerie, and to include under it in one formation all the local lithic variations.

Analysis of the Glenerie beds in the Quarry Hill syncline shows about 60 per cent of calcium carbonate, over 20 per cent of silica and about 6 per cent each of alumina and of magnesium carbonate. Some portions, however, run much higher in silica than in lime.

The Glenerie fauna includes in part:

1 the brachiopods, *Spirifer murchisoni* and *S. arenosus, Lepto-*

coelia flabellites (robust variety approaching *L. acutiplicata*), *Palaeoglossa spatiosa?*, *Leptostrophia oriskania* and *L. magnifica*, *Rhipidomella musculosa*, *Plethorhyncha pleiopleura* and *P. barrandii?*, *Centronella sinuata*, *Eatonia peculiaris* and *E. sinuata*, *Coelospira concava*, *Meristella lentiformis*, *Reticularia saffordi*, *Chonetes hudsonicus*, *Schellwienella becraftensis*, *Brachyprion majus*, *Anoplia nucleata*, *Hipparionyx proximus*, *Leptaena rhomboidalis ventricosa*, *Rensselaeria ovoides*, *Pholidops*, *Merista lata* etc.;

2 the gastropods, *Diaphorostoma desmatum* and *D. ventricosum*, *Platyceras gebhardi*, etc.;

3 the trilobites, *Synphoria stemmata*, *Homalonotus vanuxemi*, *Phacops logani*;

4 the pteropod, *Tentaculites elongatus*;

5 the crinoids, *Edriocrinus sacculus*, *Ancyrocrinus quinquepartitus* and unidentified stem segments;

6 the worm tubes, *Autodetus beecheri* and *Cornulites?*; and the burrow, *Taonurus cauda-galli*; also branching burrows ("fucoids");

7 the coral, *Enterolasma strictum?*;

8 small ostracods similar to those from Maryland;

9 a few bryozoans (*Monotrypella?*, a fenestelloid etc.).

Supplementary Notes

[1] See A. W. Grabau 1906, p. 157-68, R. Ruedemann 1930, p. 56-58. The latter reports (p. 57) that this bed is interrupted on the outcrop for a space in the southern Helderbergs.

[2] First mentioned by W. W. Mather (1843, p. 335) and later by W. M. Davis, and N. H. Darton (1894, p. 405, 497), the fuller accounts are given by J. M. Clarke, 1900, p. 74-75 (fossil list) and by Van Ingen and Clark 1903, p. 1201-3 with the most complete list of species on p. 1203 that has been published, 94 in all, 56 of which are republished by A. W. Grabau, 1906, p. 305.

10 ESOPUS SHALE

The inadequacy of our petrographic terms for sedimentary rocks is nowhere better evinced than by the efforts to name this rock. "Cocktail (or Cauda-galli) grit" expresses its true character no better than the present substitute, Esopus "shale." Shale it is not, and grit it is not. "Siltyte" would be more appropriate, yet still would fail to convey a precise impression of this almost unstratified, strongly vertically cleaved and gravelly-crumbling mass of uniform, barren, dark-gray stuff, two hundred fifty to three hundred feet thick in our area.

Where undercut along the strike and cleavage planes, as on the Cats kill at the north margin of our map (figure 78) and on the Esopus creek (figures 32, 33) at the Glasco-Mt Marion bridge (which is the "type locality") the Esopus "grit" forms smooth banks

Figure 32 Esopus shale on west bank of Esopus creek at type locality, Sauer's bridge, three miles south of Saugerties, on route 9-W. Note vertical cleavage and lack of visible stratification except in hard bed at base. Camera stands on Glenerie limestone. Looking northwest. Photo: April 1928, G. H. C.

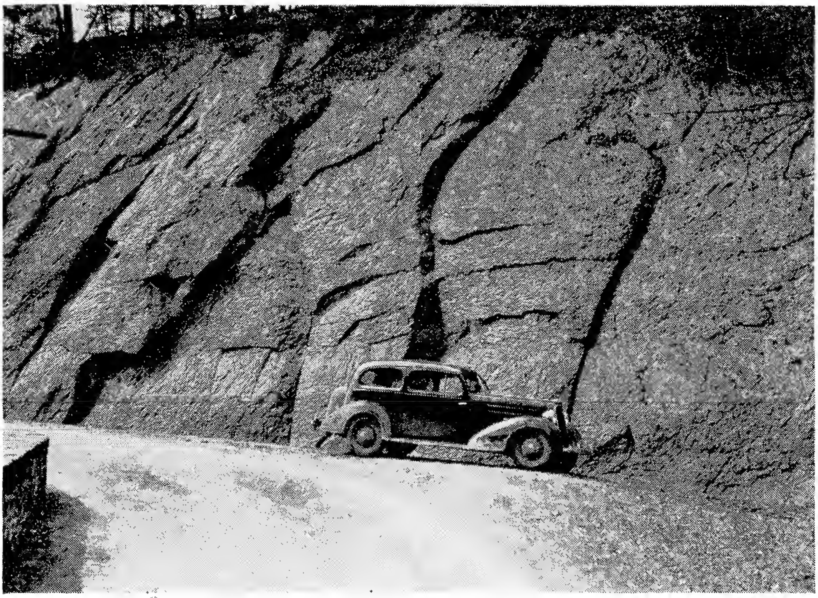

Figure 33 Detail of cleavage in Esopus shale of type section (figure 32). Only faint color bands represent the stratification. Dip is away from camera. Looking west. Photo: April 1938, W. J. Schoonmaker.

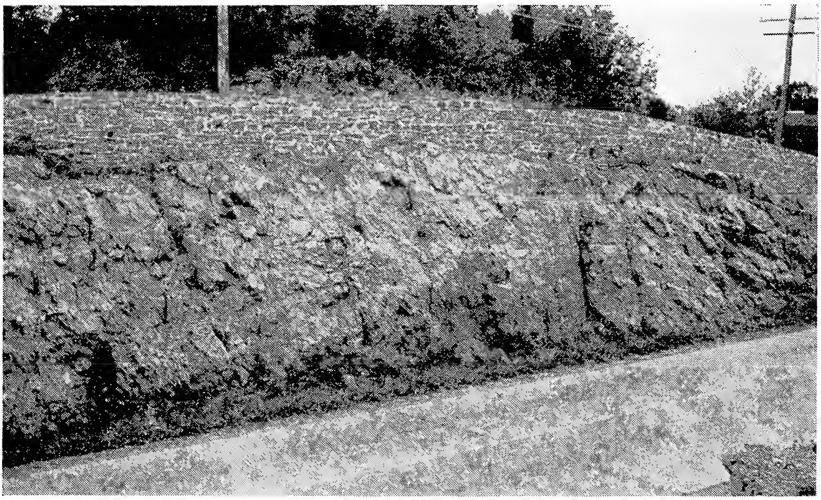

Figure 34 Schoharie shaly limestone (top beds) in low anticline on route 32 just west of Saugerties, near junction with Old King's road. Silicious nodules make rows of whiter spots. Looking northeast. Photo: September 1936, G. H. C.

of light gray aspect, with the surface covered by small cubical bits so as to resemble a huge pile of finely crushed stone.[1] But where cut transversely, as in the high "wheel" cliff at Leeds Mills just north of our area or on the Esopus creek below the West Shore Railroad bridge (Glenerie falls), the rock stands out in dark forbidding crags with very resistant appearance and a steep or vertical false bedding due to the pronounced cleavage.

On the uplands it gives rounded hills with fair soil, usually cultivated or at least cleared for pasture, whereas usually the limestones that emerge from beneath it and often the Schoharie above it are left in timber. When the Esopus is not cleared it carries an oak forest with trailing arbutus, mountain laurel, wintergreen and other sand-loving plants, or a second growth of juniper, whereas the limestone ridges support evergreens (hemlock, pine, spruce), maples, sassafras and dogwood more abundantly and the lime-loving ferns.

The general absence of stratification has an exception in the lower 40 feet, in which there are at intervals prominent layers about a foot thick that sometimes prove to be cherty. On the Esopus creek these beds are very silicious (figure 32), so resistant as to make a strong rib of rock lengthwise of the stream at the Mt Marion bridge, where Darton has called them "Oriskany"; but they shoot well over the Glenerie limestones. Some fossils, however, continue upward into this basal portion, especially the robust variety of *Leptocoelia* that flourished in the Glenerie. Rounded flint nodules of several inches occur at definite levels. This fossiliferous and stratified lower portion may eventually require a distinctive name. The most interesting collections have been made about a mile east of Leeds.

The most abundant and characteristic fossil of the Esopus is the spiral worm-burrow, *Spirophyton* or *Taonurus caudagalli,* which increases in prominence toward the top of the formation.

The full list of species, mostly from the lower 40 feet, is:

1 the burrow, *Taonurus caudagalli,* and a tubular burrow (*Buthotrephis*?) exactly like that in the Port Ewen beds;

2 the brachiopods, *Leptocoelia flabellites* (variety?), *Chonostrophia complanata, Orbiculoidea* sp., perhaps *Ambocoelia* sp.(?);

3 a gastropod, *Platyceras* sp.;

4 a goniatite with closely spaced septa, about as simple as *Agoniatites,* from the railway cuts north of the Kingston tunnel.

All this material was given to Dr J. M. Clarke for study but became mislaid.

Supplementary Note

[1] See N. H. Darton 1894, plate 3 opposite p. 510, for this cliff, and plate 2 opposite p. 402 for the cliff at Leeds. Since the latter cliff is 120 feet high, and the nearly vertical mass at the right also belongs to the Esopus, it is easy in this view to measure 250 feet thickness, excluding about 10 feet of (thrust duplicated) Glenerie beds in the core of the arch. The 40 feet of more stratified Esopus next above the Glenerie are well shown in the picture. The cliff at Glenerie at its highest point, the boardinghouse not far north of the falls, is 200 feet high, to which dip will add at least another hundred; so that on this south part of the map the thickness must reach 300 feet. Darton (1894, p. 403) named this rock Esopus "slate", a term by no means as inappropriate as the others, from, he says, "the Esopus settlement" (now Kingston) "and the Esopus creek"; but since the complete section is exposed only on the latter, we must look upon it as the real type section and locality.

11 SCHOHARIE SHALE

The 60 to 80 feet or more of beds mapped as Schoharie were formerly included by all writers in the preceding formation, the Cauda-galli or Esopus. Discovery of characteristic Schoharie grit fossils in them at Becraft's mountain led Doctor Clarke (1900, p. 13-15) to observe the lithic differences and to give these beds proper recognition. Similar conclusions had been earlier reached on the west side of the river by E. R. Beardsley, R. W. Jones and the writer, but not published until later; in fact, there had been a growing general conviction among all field workers of a valid lithic and faunal distinction from the Esopus, of stratigraphic continuity of these shaly lime-mudrocks with the thin bed of true sandrock in the Helderbergs known as the Schoharie "grit" from its outcrop on the hills above Schoharie Court House in Schoharie county and of the presence hereabouts of many of the distinguishing fossils of that stratum. Thereafter, this recognition became unanimous.

These beds are harder, more calcareous and browner on weathering than the underlying Esopus and they break into much larger pieces than that rock. This is well illustrated in the arching surface of the Schoharie on which stands the old stone church in Leeds, on route 23 just north of our map, a surface that for the regularity of its minor jointing looks like a brick pavement.

Some of the smoothly arched anticlinal hills of this formation, just unroofed of their limestone cover, are cleared and cultivated, but more often the inclined or vertical beds give ragged ledges and rugged ridges still in timber. The Schoharie is in fact a highly resistant rock and it has a marked physiographic effect in contrast with the subdued Esopus topography. At many points the Esopus forms only a broad vale or meadow between upturned ridges of Schoharie on one side and subjacent limestones on the other. It is

only here and there, in anticlines, that the Esopus stands higher and the Schoharie sinks back down the flanks of the hill.

To give a meaningful lithologic name to the Schoharie is even more difficult than it is for the Esopus. Less shaly than that, it is in no sense a "grit" as at Schoharie, but instead it is in our region and southward a fine-grained impure limestone or calcareous mudrock for which "marlyte" might do if the lime content were higher (figure 34). Nevertheless, the rare limestone plants such as the walking fern, purple cliff brake and ebony spleenwort find footing upon it quite as readily as on the purer limestones.

The Schoharie is the third of such rocks in our series. Its characteristic "coffee-and-cream" fragments, usually crudely shaly but often with bulging centers, are rather closely imitated by the lower Glenerie at many points and again by certain layers in the New Scotland (Catskill shaly). These resemblances are sufficiently close to demand caution in faulted areas, though usually the fossil contents will announce which rock is outcropping. No places have been found where the Glenerie is in fault contact with the Schoharie, however, though the intervening Esopus is sometimes wholly under cover of alluvium; so that such difficulties are between the Glenerie and New Scotland and do not affect the Schoharie, which lies to the west of those except in the Streeke syncline. Were fossils in the Schoharie as numerous as in the New Scotland, doubtless it likewise would have been called a "shaly limestone."

These fossil contents are, indeed, rather limited to the uppermost portion and are none too abundant there, while the lower part is increasingly more impure and more like the Esopus. The exact line between these formations is marked by glauconite, with abrupt cessation of the "cocktail" (*Taonurus*) markings and substitution of an obscure branching tubular burrow(?). Stratification becomes more distinct, with often a thin limestone band not far above the base of the Schoharie (figure 64). The physiographic line is usually a definite depression in the topography, or a terrace quoin. The middle and higher portions of the Schoharie are readily known, even the topmost part which becomes heavy-bedded like the Onondaga above it (figure 35), from which too it is separated by glauconite and distinguished by color and slaty cleavage.

The fossils of the Schoharie shale hereabouts, chiefly from the top, are:

1 the brachiopods, *Atrypa impressa, Spirifer macrus, Strophonella ampla, Schellwienella pandora, Delthyris raricosta, Stropheodonta demissa, Dalmanella peloris, Chonetes hemisphericus, Reticularia fim-*

briata, Leptaena rhomboidalis, Orbiculoidea sp., *Lingula ceryx?;* (Clarke lists also *Coelospira* cf. *camilla, Chonetes* cf. *arcuatus*);

2 the trilobites, *Synphoria anchiops, Calymene calypso;* (Clarke adds *Phacops* cf. *bombifrons*);

3 the cephalopod, *Orthoceras zeus;*

4 the gastropods, *Orthonychia* cf. *arcuata, Platyceras* sp.;

5 the sponge-boring, *Clionolithes radicans;*

6 bryozoans, *Monotrypa* etc.

From the top bed at Becraft's mountain (which Grabau 1903, p. 1070, took to be basal Onondaga) Doctor Clarke reports also (1900, p. 14) the following:

1 the brachiopods, *Spirifer varicosus, Atrypa reticularis* "large and rotund" (*?A. impressa*);

2 the trilobite, *Odontocephalus selenurus;*

6 the bryozoan, *Fistulipora* (or *Stromatopora*), incrusting;

7 the corals, *Chonophyllum, Zaphrentis, Favosites* (branching).

12 ONONDAGA LIMESTONE

The great "Corniferous" or "Upper Helderberg" limestone marks a return to coral-reef conditions after the long interval of the "grits" and is the last limestone formation in eastern New York. Split Rock in Onondaga county is the type locality for the present name, Onondaga limestone,[1] but there have been other uses of the name Onondaga. Our Onondaga limestone (figures 35-39) forms conspicuous ledges characterizeed by an abundance of "black" chert seams in a rock that though dark internally weathers strikingly "white" and by massively jointed cliffs and blocks that are easily recognizable even when glacially transported far from the outcrop. Chert is, however, practically missing from the top 12 feet or so and in the basal four to eight feet. Fossils are usually plentiful, especially rather large silicified horn corals, honeycomb and organpipe corals in the cherty middle layers.

The probable thickness of this massive limestone in our area is about 60 feet, as Darton gives it (1894, plate 1 opposite page 396, and pages 491, 496), but good opportunities for measurement are lacking since the summit contact is known at but one point (figure 40). Resistant as the Onondaga seems at most exposures, forming very picturesque ledges, it is surprisingly weak at others and retreats far down the back slope of the Schoharie or wholly disappears under alluvium. Indeed, where the larger streams cross it the Schoharie usually makes the fall while the Onondaga goes under water behind the fall. These anomalies may be due either to its greater

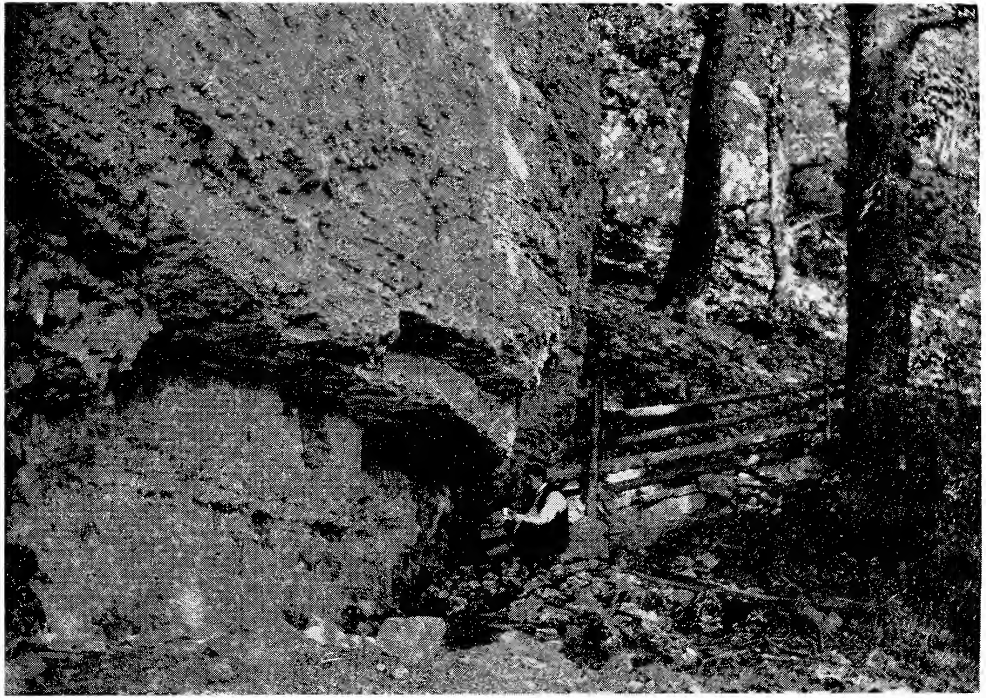

Figure 35 Contact of Onondaga limestone on Schoharie limestone at Webber farm, one-half mile west of Cauterskill, on north side of the Kaaters kill. Hiram Wilcox marks top of Schoharie at spring issuing from bottom of syncline, the layers rising again beyond the tree. Looking east. Photo: September 1911, G. H. C.

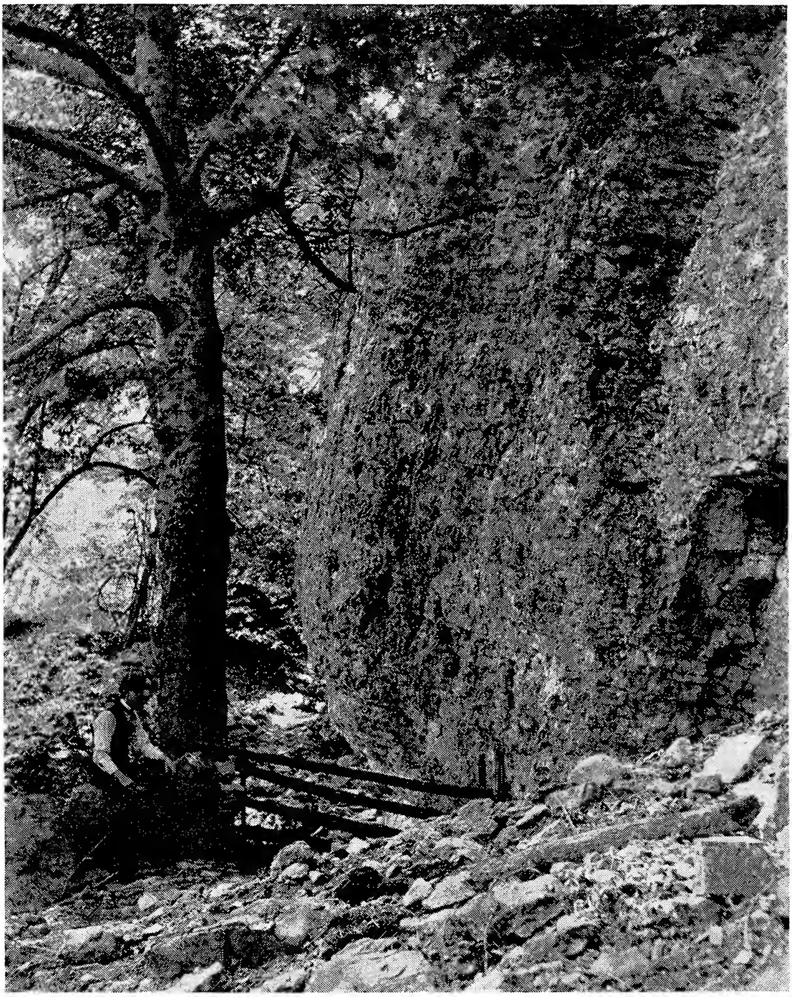

Figure 36 Onondaga limestone at same locality as figure 35, showing unusual thickness of the massive chert-free lower portion. Path to cave goes up right foreground. Looking west toward spring. Photo: September 1911, G. H. C.

Figure 37 Onondaga limestone arch at Quatawichna-ach, on the Kaaters kill, four and one-half miles southwest of Catskill. Beds very near top of the Onondaga, as Bakoven shale occurs just downstream. Right background is Timmerman's hill of the Hooge Berg range (Mount Marion beds). Looking southwest, below bridge. Photo: September 1936, G. H. C.

Figure 38 Detail of same beds as figure 37, under the bridge, showing the chert seams, and the cavernous character which takes the normal flow of the stream underground and gave it the Indian name ("place where water all goes in a hole"). Looking south. Photo: September 1936, G. H. C.

Figure 39 Limekiln on Onondaga limestone outcrop at Katsbaan corners on route 32 three miles north from Saugerties. This stood on south side of the road behind filling station west of the corners, but has been torn down. Looking southwest. Photo: April 1928, G. H. C.

solubility or to the fact that its open jointing made easy its plucking away by the ice sheet. In confirmation its huge squarish boulders are widely distributed eastward and southward by the glacier, even to the river shore, and appear at the most unexpected places, with their rare ferns. The Onondaga has more true outliers than the other formations, perhaps for the same reason.

The purity of the Onondaga limestone matrix caused it to be much in demand for quicklime. Many old kilns (figure 39) mark its outcrop; others have been torn down. It has also been used for a building stone, as in the Webber bridge on route 23-A. Its purity and its jointing again have been favorable to subterranean solution, resulting in some very impressive looking caverns.

Within our area the fauna of the Onondaga limestone has not been adequately investigated. The more easily recognized forms that it affords here are these:

1 the corals, *Synaptophyllum simcoense, Striatopora cavernosa* and *Favosites emmonsi?;*

2 the brachiopods, *Atrypa aspera* and *A. reticularis, Schellwienella pandora, Spirifer duodenarius, Leptaena rhomboidalis, Strophonella ampla, Stropheodonta demissa?, Delthyris raricosta, Chonetes lineatus?, Schizophoria propinqua;*

3 the gastropods, *Platyceras dumosum, Diaphorostoma turbinatum;*

4 the trilobites, *Odontocephalus selenurus, Phacops cristata;*

5 various bryozoans;

6 the fish tooth, *Onychodus sigmoides.*

Supplementary Note

[1] The applications of the name Onondaga, and the appellatives of the Onondaga limestone, have had a checkered history. With reference to what we now call the Salina series of Silurian age in central New York, Vanuxem in 1839 (page 249) used the expression "Saliferous group of Onondaga," which was repeated by Hall (page 290) in the same report. But on page 293, Hall varies this to "Onondaga saliferous group," thus to the technically minded first validating it as a stratigraphic term. Lower on the very same page (and again on page 309) Hall introduces "Onondaga limestone" for only a thin lower portion of the rock to the whole of which the name is now applied. For the major portion of our Onondaga he follows Vanuxem (page 275) in employing the latter's newly introduced name "Seneca limestone" (Hall, pages 293, 310), distinguishing it by its darker color from the "gray sparry crinoidal" Onondaga limestone below, with which he says it "in some instances alternates" (page 310). "Onondaga limestone" was first applied to the whole mass by Conrad in 1842 or Emmons in 1846, but does not seem to have had currency in this sense until used by Hall on the McGee map of 1894, apparently there including also the Schoharie beneath.

Instead, the widely accepted term was at first Corniferous and later Upper Helderberg limestone, while Onondaga continued to designate the Silurian salt-bearing series. The name "Corniferous" (or at first "Cornitiferous") refers to the content of hornstone chert and was introduced by Amos Eaton as early as 1823, and defined in corrected spelling by him in 1839 (American Journal of Science, 36, page 61). The name was taken up by John Gebhard jr and

accepted by Mather in 1840 (page 237) but ignored by Hall (page 452) in the same report; he used Onondaga (perhaps in the present sense?, pages 418, 427), while Vanuxem (page 378) inserts it between the Onondaga and Seneca limestones, and thereafter in these early reports and the final volumes, one or both of these members were separated from it. (Emmons 1842, page 429, uses "Helderberg limestone" instead.)

"Upper Helderberg" was a term apparently originated by Hall in 1851 (Foster and Whitney's report, volume 2, page 163) in a breaking up of the old Helderberg Division and included the "grits" as well as the limestone, but it eventually settled down pretty much to the limestone (L. Lincklaen 1861, F. J. H. Merrill 1898), and had long acceptance.

Meantime the duplicate use of "Onondaga salt group" continued in full favor in these reports and all four final volumes of the survey and thereafter, there being no alternative term until J. D. Dana coined Salina in 1863. In Dana's last edition (1895, page 552) he still uses Onondaga period to comprise the Salina group and the Waterlime group (inclusive of Manlius) and retains the name Corniferous for our Devonian limestone. Seneca was appropriated by Clarke and Schuchert (1899, page 877) for their Senecan period of the Upper Devonian. To restore these names now to their value as of first publication would entail endless confusion. (See Darton, 1894, p. 401.)

13 BAKOVEN BLACK SHALE

Our knowledge of this rock in our area is derived from five small exposures; the rest of the way its outcrop is buried under Pleistocene clays and glacial deposits along the line of the Bakoven valley which its weakness has produced. This is the Marcellus valley of W. M. Davis (1882, page 29), for the Bakoven is of Marcellus age and was long supposed to represent the entire Marcellus of central and western New York.[1] This valley (figures 3, 74) marks the back line of the Kalk Berg range and lies between the last of the limestones (the Onondaga) and the high range of the "Hamilton" sandstones, the Hooge berg, now known to be also of Marcellus age.

The best and long famous exposure of the black shales (figure 40) is on the Kaaters kill at the Webber bridge of the Catskill-Palenville road (route 23-A). Approximately 75 feet of the shale and its thin calcareous layers are here revealed, resting directly on the Onondaga limestone summit; but the upper portion of the section is much crumpled, so that only 54 feet can be accurately measured (to the mouth of the first gully) nor is there any way of knowing how much more lies between it and the Mount Marion formation on the opposite side of the clay-filled Bakoven valley. Another but very small exposure, wholly isolated, is visible at low water about a half mile upstream, nearly opposite the old stone house[2] of the Abeels, and furnished interesting fossils from what may also be the Cherry Valley member. The beds here dip east (about 7° to 8°), opposite to the previous dip.

Another small exposure of the lower beds, much ice-crumpled, is on the east bank of the Kaaters kill at the 60-foot contour crossing below Quatawichna-ach.

The summit contact is seen at the "coal mine" below the falls at

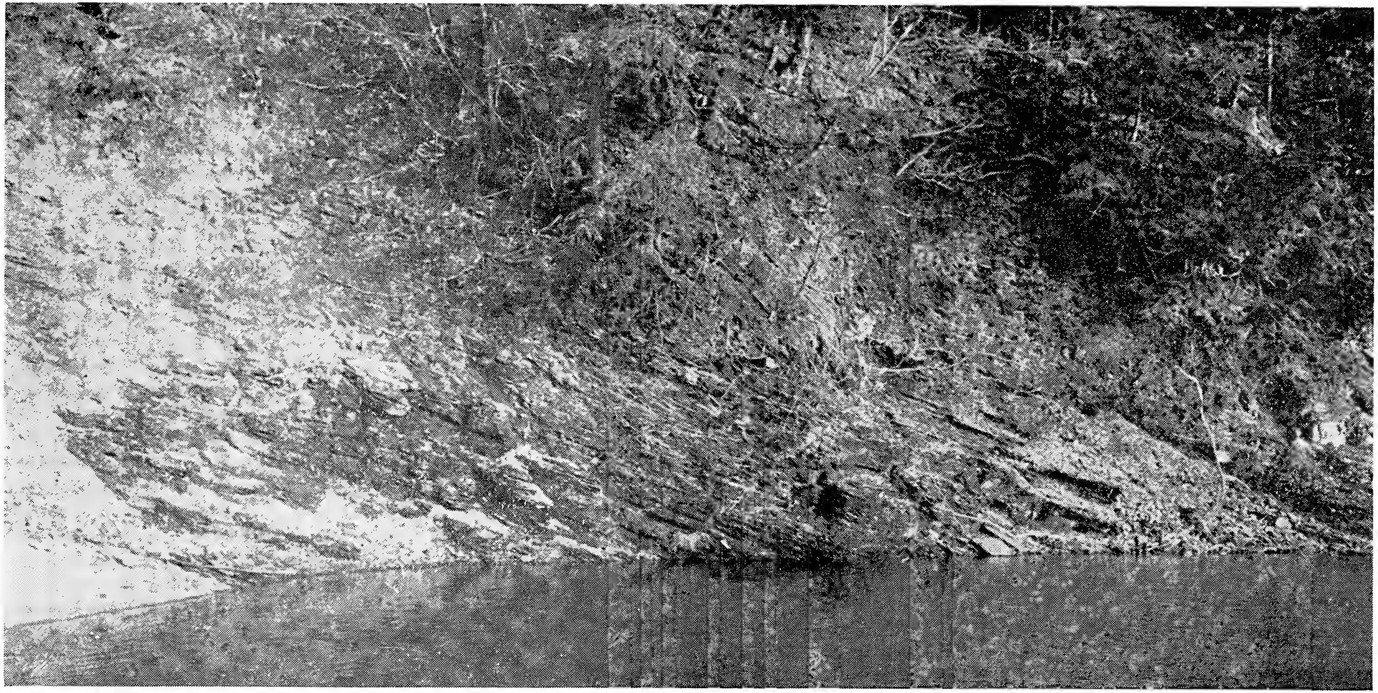

Figure 40 Bakoven black shale at type exposure, overlying Onondaga limestone (tip shows at left) on upstream side of Webber bridge over Kaaters kill, Rip Van Winkle trail, four miles from Catskill. The shale extends to the top of the bank, and far to right (down dip); about 50 feet thickness shown in view. Looking east-southeast. Photo: April 1938, W. J. Schoonmaker.

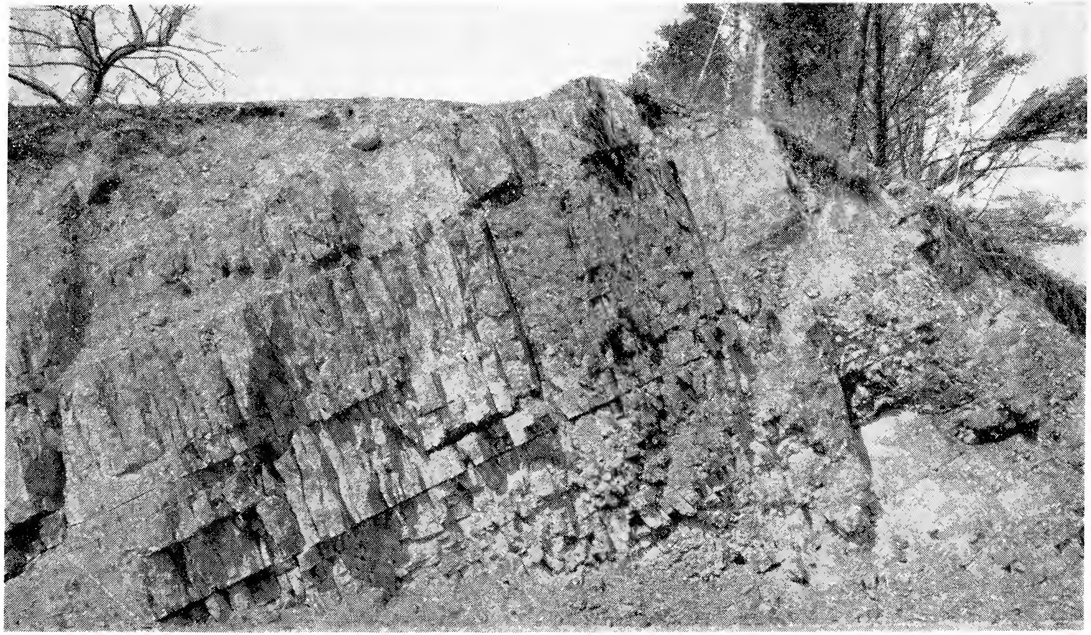

Figure 41 "Hard beds" of lower Mount Marion formation in cut at sharp bend of Rip Van Winkle trail four and one-half miles (by road) west of Catskill. Incipient cleavage (close jointing) due to steepening of west dip on this east front of the Hooge berg, (see figure 3, taken one-half mile northeast). Dip is to left, 25° west. Looking north-northeast. Photo: April 1928, G. H. C.

Wesley Houck's farm, a half mile southwest of the bridge over the Kaaters kill at the Quatawichna-ach, but unfortunately the Mount Marion "brown" sandstones have here ridden up eastward over the shales, crushing and crumpling these and obscuring the normal relations. The drag zone in the top of the "black" shales is from three to five feet thick, with so much slickensiding of the shales as to have given the impression of anthracite coal. A tunnel was therefore drifted into the hillside, extending 50 feet northward along the contact, but of course no coal was found. Nevertheless some of the shale here and also at the Webber bridge is sufficiently bituminous to yield a flame when put upon a hot fire, but the appearance and odor of "oil" sometimes obtained upon fresh fracture is chiefly due to sulphur compounds of no commercial value. A little natural gas, however, was struck in the Marcellus (Bakoven) black shale by a waterwell drilling near Veteran.

About 35 feet of the Bakoven beds are seen in the brook at Houck's "mine." A few rods east, lower layers appear in the Kaaters kill, similar to those at the Abeel house. Dip calculations suggest that the total thickness of the Bakoven represented at Houck's may be about 100 feet, with about the same amount more to reach the Onondaga on the east of the Kaaters kill, or 200 feet in all. But if there is a roll in the strata here as at Abeels and if the zone there and here seen in the creek is the Cherry Valley member, then the total drops to 140 feet. Only some deep well records can solve this problem.

The basal one inch, in contact with the Onondaga at the Webber bridge exposure (sometimes covered by debris), is a calcarenyte of tiny crinoidal fragments, black in color like the shale and containing also comminuted fish remains with an occasional brachiopod shell seemingly reworked from the limestone beneath. The basal contact here shows this bed bonded into solution pittings in the limestone, indicating a distinct break and disconformity.

The fossils found in the Bakoven beds in our area, besides the lost specimens of goniatites, include:

1 the diagnostic brachiopod of the Marcellus, *Leiorhynchus limitare; Leptaena rhomboidalis,* also in the basal film, *Atrypa aspera;*

2 the pteropods, *Tentaculites gracilistriatus, Styliolina fissurella;*

3 a crustacean, *Estheria* (new species?);

4 fragments of plant stipes, roots, and Aphlebia(?);

5 the plant spore-case, *Protosalvinia huronensis;*

6 the fish tooth, *Onychodus hopkinsi;*

7 a possible arthropod podite.

Supplementary Notes

[1] It is not yet certain just how much of the Marcellus is here black shale. A concretionary zone at 35 feet (not 50 feet) above the base furnished to Marshall Kay and his students small umbilicate cephalopods (*Agoniatites* or *Anarcestes?*; unfortunately lost before identified) that suggest the equivalence of this zone to the Cherry Valley limestone member. If that is correct (and it is in keeping with the thickness and variability of the beds below this zone), then we have here 35 feet of the Union Springs member, possibly 6 feet referable to the Cherry Valley limestone member, and hardly enough additional thickness to account for all of the Chittenango member of the lower or typical Marcellus. See Chadwick and Kay 1933, p. 6; in which guidebook the name Chittenango is used by Kay for all these, prior to publication of Bakoven by Chadwick (1933, p. 480, 483).

[2] This house, visible from the highway (23-A) was the scene of one of Brandt's raids.

14 MOUNT MARION BEDS

Short of the mountains themselves, Mt Marion (figure 2) is the highest point in our map on the west side of the Hudson. In form and expression it is characteristic of the entire Hooge Berg range, which consists of the same sandstones and shales. Steep easterly fronts, often with a naked summit ledge, and long back-slopes (figure 3) are the outstanding features due to these west-dipping strata which rise into peaks 600 feet above sea level (754 feet on Mt Marion) and must exceed 800 feet in thickness (figures 41-45). They are the Hamilton beds of former writers, named from Hamilton in Madison county, but they are now known to represent but a part of the Hamilton group and to belong in its lowest or Marcellus division (see Grabau, 1917, p. 954, for definition of name; Cooper, 1930, p. 234, 1933, p. 200, for correlation with Marcellus). They seem to correspond roughly with the Cardiff or upper Marcellus of central New York, but have here passed shoreward into the brachiopod facies that the higher Hamilton beds have in their typical exposures there. This is the highest formation in the section to hold marine fossils for the whole length of our map area, those that succeed it being generally of continental origin, but it is allied with those beds above in being the first of the great delta deposits here seen.

The fossils of the Mount Marion beds are those diagnostic of the Hamilton group (in its limited sense, exclusive of the Marcellus) in central New York, but they here extend down into beds of similar lithic character that eastward from there have replaced the black Marcellus (mostly Cardiff) shale of the more western areas. In this we have the inauguration of those deceptive changes in facies, landwardly, upon the great delta deposits forming across New York State from the close of Onondaga time onward through the rest of the Devonian, of which we shall see more presently and which have

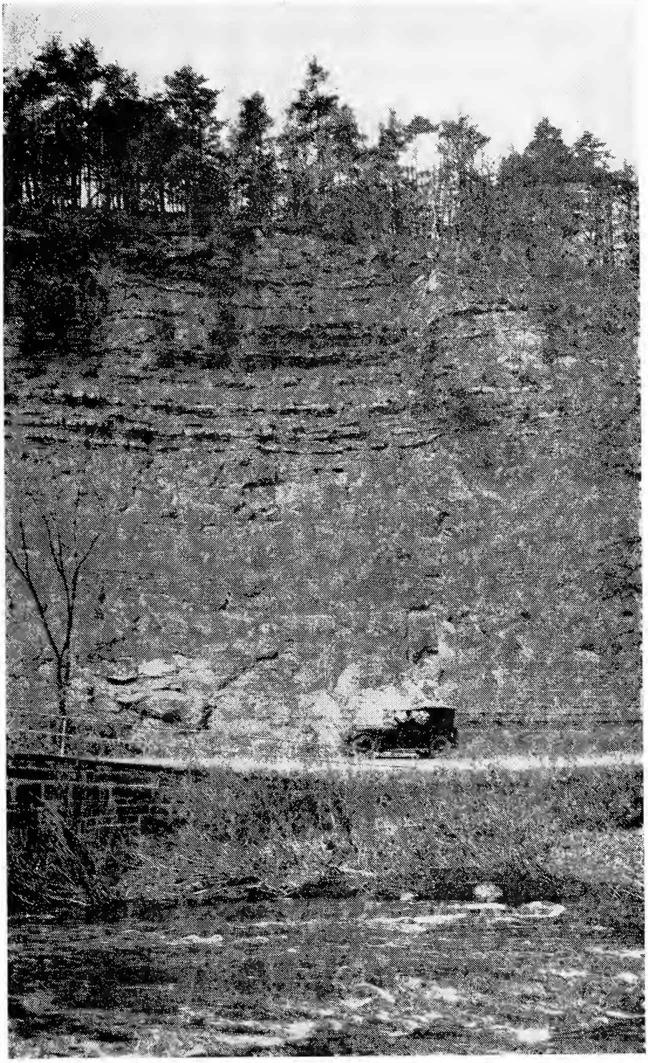

Figure 42 Mount Marion beds, middle portion, at bridge over Platte kill one mile west of Mt Marion railroad station on road to Highwoods and Daisy. Type exposure. Fine talus dug for road "gravel." Low dip away from camera. Looking west-southwest. Photo: April 1928, G. H. C.

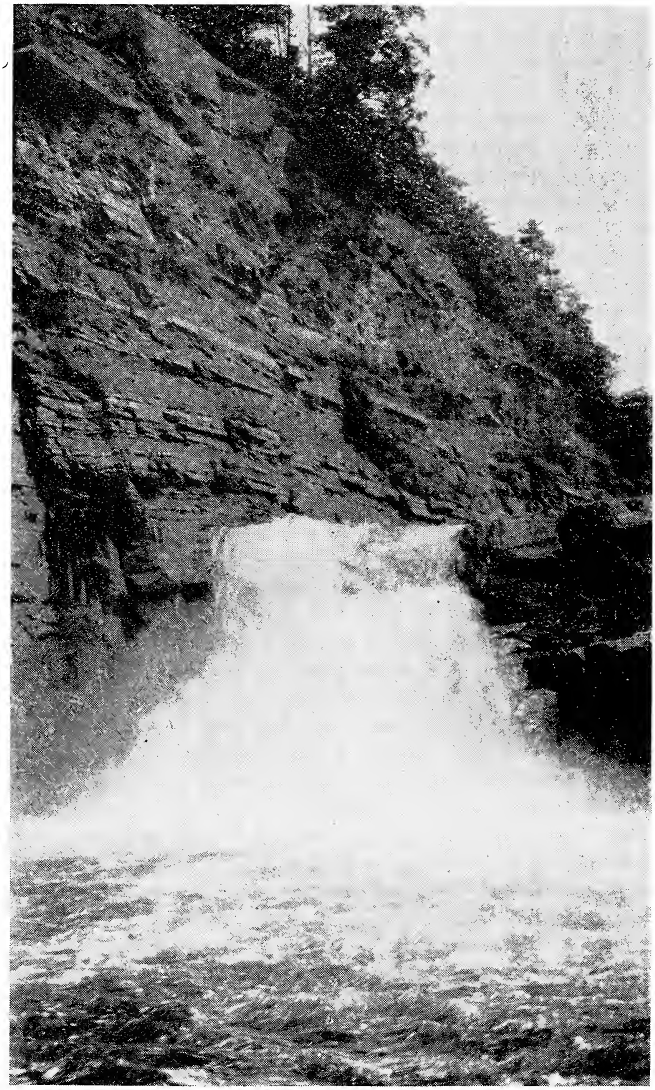

Figure 43 Mount Marion beds, upper portion at High Falls of the Kaaters kill, eight miles from either Saugerties or Catskill. In summer flood, showing two heavy sandstone layers, with gentle west dip, that make the falls, and weaker layers in cliff above. Looking north. Photo: July 1928, G. H. C.

in the past so seriously misled us in the correlation of these beds. By actual field tracing, the Mount Marion beds have been proved by Doctor Cooper to be not "Hamilton" in the limited sense, as they were called from their appearance and fossils, but Marcellus, which in its typical expression as black shales they do not in the least resemble.

The name applied to these strata was given at the time when the Hamilton age of also the overlying Ashokan flagstones was first beginning to be recognized, so that a distinctive term became necessary. But it was little realized then that even the Ashokan is low in the Hamilton group instead of being its top. We owe much to the careful and discriminating field work of Dr G. Arthur Cooper.

No satisfactory subdivision of the Mount Marion formation has yet been attained, though such a subdivision (and correlation with the members distinguished farther west in the Cardiff) will doubtless be worked out in time. The lower layers for a thickness of perhaps 100 feet are nearly homogeneous, fine-grained, argillaceous, barren sandstone, whose bedding planes are often obscured by a strong vertical cleavage (figure 41) and which tend to break up into blocky pieces. The fresh color of this rock is bluish gray, becoming a tan or coffee-brown in the exposure. Fossils are practically absent from this portion, which is well seen at Miner falls, five-eighths mile west-southwest of Asbury, and at Mr Houck's "coal mine" three miles farther north. Another exposure is at the four corners one-half mile west of Mount Marion station and in the Platte kill immediately adjoining. It is just below this point that the Platte kill begins to flow across the alluvial flats that gave it its name (see note 12 on p. 19). Here, a single very fine specimen of *Palaeoneilo fecunda* was found in the blocky shale fragments in the road gutter. This member may represent the Chittenango portion of the Mount Marion, if such there be.

Three-fourths mile farther west on this road, toward Unionville, just over on the Kaaterskill quadrangle, is a high bank (figure 42) of the main mass of the Mount Marion formation, continuous with the Mt Marion hill itself on the north and extending along the west bank of the Platte kill at the iron bridge. Nearly 150 feet of beds are here exposed (the lower third showing downstream) though all are largely inaccessible in the steep face. The upper third of this exposure and the lowest 10 feet are full of sandstone intercalations up to a foot or more in thickness, but the general mass is an arenaceous or argillaceous shale. At the base of the middle third, by the roadside at the bridge, is a harder bench carrying many specimens of

Spirifer granulosus, besides *S. audaculus, Leptostrophia perplana* and an *Orthoceras.* The blocky blue shales above this afford on careful examination many species, chiefly pelecypods. In an hour's collecting, Professor Prosser (1899, page 294) secured 28 species from this cliff; the writer in about the same length of time obtained mostly additional forms. Another *Spirifer* bed lies in the water under the bridge. The forms collected here indicate a horizon not lower than the Bridgewater member of the upper Marcellus. These beds must lie about midway in the Mount Marion formation. In the creek bed at the lower end is a layer with large "staghorn" corals.

A zone intervening between the two just described seems to be represented along the northeast base of the mount itself, where the most common form in the massy dark blue shales is the small coral *Ceratopora.* A *Cyathophyllum* (*C. nanum?*), the goniatite *Tornoceras uniangulare,* a large frilled form of *Atrypa reticularis* like those from Independence, Iowa, and a variety (new?) of *Schellwienella pandora* were also obtained from these shales and thin interbedded sandstone, but fossils are rare. This zone is probably lower Bridgewater.

The higher part of the Mount Marion formation is seen at High falls (figures 43, 44) on the Kaaters kill, where rather heavier sandstones predominate for some distance upstream, but sandy blue shales form the gorge below the crest of the fall. It is these harder layers that make the ledges topping Mt Marion, Mt Potick (just over on Coxsackie quadrangle to north) and other hills of the Hooge Berg escarpment and their position suggests that they are in the Solsville sandstone member with the more shaly Pecksport overlying them and terminating the Mount Marion formation. The shales beneath the falls carry nests of *Chonetes coronatus* and about 30 other species, mostly very rare (see C. S. Prosser 1899, page 279), whereas the sandstones are often well filled with *Spirifer granulosus* and other forms.

The full list observed here in the sandstones is:

1 "fishes," *Cephalaspis?* and other ostracoderm? plates;

2 cephalopod, *Orthoceras exile;*

3 pteropod, *Tentaculites;*

4 gastropod, *Diaphorostoma;*

5 pelecypods, *Grammysia circularis, Modiomorpha* cf. *alta, Nucula bellistriata, Palaeoneilo* (or *Nucula lirata?*), and various aviculoids;

6 brachiopods, *Spirifer granulosus, S. pennatus, S. audaculus, S. acuminatus, Delthyris consobrina?, Camarotoechia congregata, C. prolifica, Chonetes coronatus, Stropheodonta concava?, Leptostrophia junia?, Schellwienella chemungensis* (*pandora?*);

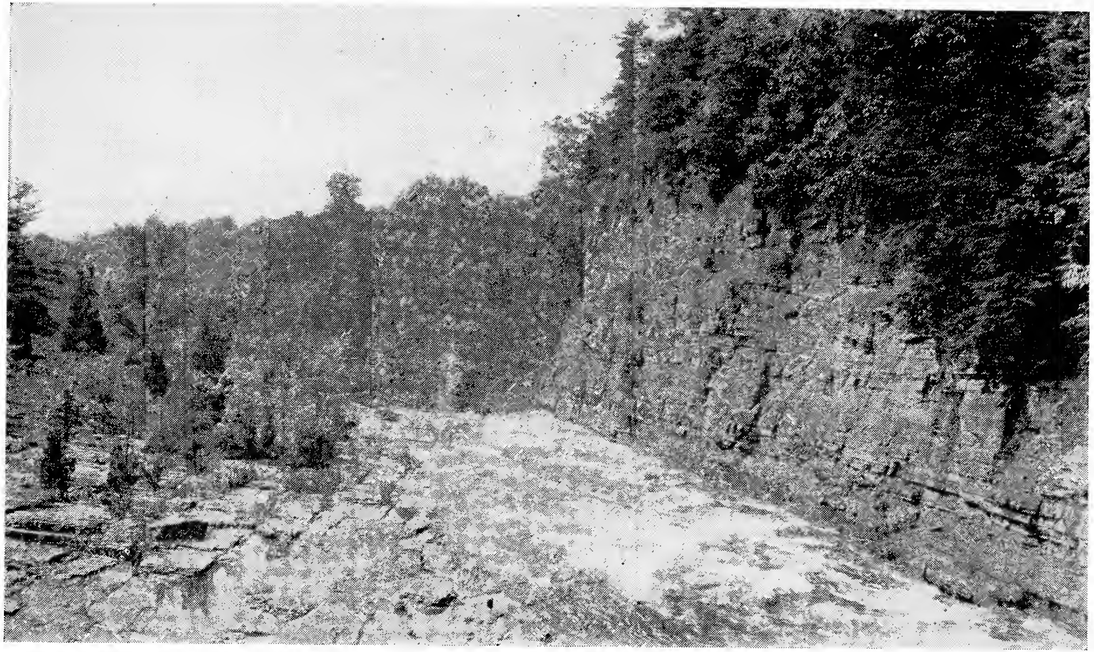

Figure 44 Mount Marion upper beds just above High Falls, showing hanging tributary in distance, below falls. The gentle west dip causes the Kaaters kill to migrate west, undercutting the cliff along joint faces and making a gorge with only one wall. Jointing of fossiliferous sandstone bed well shown on left. Looking southwest from highway bridge. Photo: July 1928, G. H. C.

Figure 45 "Storm rollers" in topmost (marine) beds of Mount Marion formation on old road just west of new alignment, Unionville. There are two such cuts near together, in the roller beds, and the nonmarine layers begin a few rods west, at road three-corners. Note west dip. Looking about south. Photo: September 1936, G. H. C.

7 bryozoans;

8 crinoid, *Ancyrocrinus bulbosus,* also columns and brachials;

9 coral, *Pleurodictyum* cf. *dividuum?;*

10 worm burrows, *Taonurus velum,* and interlacing linear burrows not necessarily of worms.

From these higher beds, far up on the south slope of Mt Marion itself, came the marvellous trove of the starfish *Devonaster eucharis* described by Dr J. M. Clarke in 1912 (page 44). More than 400 specimens were recovered from less than a square rod of sandstone (see Clarke, 1912*a,* p. 115-18, pl. 14-16, for fuller account).

Still higher, close to the summit of the formation, besides abundant shells of *Camarotoechia* and *Chonetes vicinus,* the pteropod *Tentaculites bellulus* forms a widespread layer an inch or more in thickness in what may be the Pecksport member. In the topmost beds above High falls, south of the highway (and also on the road northward), are seen the curious so-called "concretionary" masses better known as "storm-rollers" and always found to mark nearshore conditions and impending transition to continental deposits, made on the land. The finest display of these on our area is, however, in the two road cuts (figure 45) through rock noses at Unionville, between the new and the former road junction. These are worth careful inspection, in the effort to understand and explain how such structures could be formed, for no unimpeachable explanation has yet been suggested. They are not concretions, at least, as all now admit.

The Mount Marion fauna constitutes a long list for any one formation in our region, rivalled only by the New Scotland. The following are known:

1 the "fish," *Cephalaspis?* (plate), and other ostracoderm? plates;

2 the annelid burrow, *Taonurus velum;* and other burrows;

3 the cephalopods, *Tornoceras uniangulare, Orthoceras exile, O. subulatum, Geisonoceras?* sp., *Spyroceras crotalum;*

4 the pteropods, *Tentaculites bellulus, Conularia aff. undulata;*

5 the gastropods, *Bucanopsis lyra, B. leda, B.* sp., *Trepospira rotalia?, Bembexia sulcomarginata, Diaphorostoma lineatum, Platyceras carinatum?;*

6 the pelecypods, *Modiella pygmaea, Elymella nuculoides, Palaeosolen siliquoideus?, Cypricardinia indenta, Orthonota undulata, O.(?) parvula, Prothyris lanceolata, Schizodus appressus, Paracyclas lirata, Buchiola retrostriata, Sphenotus truncatus, S. subtortuosus?, Grammysia bisulcata, G. magna, G. circularis, G. alveata, G. constricta, Nyassa arguta, N. recta, Palaeoneilo constricta, P. plana, P. fecunda, P. emarginata, Nuculites triqueter, N. oblongatus, N. cuneatus?,*

Nucula bellistriata, N. varicosa, N. corbuliformis, Cypricardella tenuistriata, Modiomorpha concentrica, M. mytiloides, M. macilenta?, M. cf. *alta, Goniophora hamiltonensis, Plethomytilus oviformis, Leiopteria dekayi, Actinodesma erectum, Limoptera obsoleta, Actinopteria boydi, Aviculopecten princeps;*

7 the starfish, *Devonaster eucharis;*

8 the crinoid "root," *Ancyrocrinus bulbosus,* crinoid brachials and columnals;

9 the brachiopods, *Reticularia fimbriata, Delthyris consobrina?, Spirifer pennatus, S. audaculus, S. granulosus, S. acuminatus, Athyris* cf. *spiriferoides, Atrypa reticularis* variety, *Tropidoleptus carinatus, Camarotoechia congregata, C. prolifica, C. sappho, Strophalosia truncata?, Chonetes coronatus, C. vicinus, C. scitulus, C. lepidus, C. setiger, Leptostrophia perplana, L. junia?, Stropheodonta concava?, Schellwienella pandora, Schizophoria impressa, Rhipidomella vanuxemi, Lingulodiscina* sp., *Dignomia alveata, Lingula densa, L. compta;*

10 bryozoans not identified;

11 the corals, *Ceratopora distorta, C. dichotoma?, Eridophyllum?* sp., *Cyathophyllum nanum?, Cystiphyllum* sp., *Zaphrentis* sp., *Pleurodictyum dividuum?;*

12 the boring sponge, *Clionolithes radicans?;*

And very rarely, carbonized plant stems or stipes; also simpler forms (rootlets?) that have been called "Psilophyton."

15 ASHOKAN FLAGSTONES

The old flagstone quarries (see Dickinson, 1903, map on pl. 2 and p. 17-34) extend along the west flank of the Hooge berg from Dutch Settlement (Ruby) northwards, by Highwoods, Fish Creek (Vanaken Mills), Unionville (Centerville, Veteran), Quarryville and Great Falls (High Falls) to the Catskill-Lawrenceville road on Bethel ridge and the "Five-Mile Woods" at the north limit of the quadrangles. The successful quarries have, in general, been kept near to the main roads and to the outlets eastward through the Hooge Berg range, and their absence in the vicinity of the Catskill-Palenville road (route 23-A) has been due to the morainal overburden that here conceals rock for some distance. A higher belt of flagstone quarries lies to the west, in the red beds, extending up almost to the summit of Plattekill mountain, as described beyond.

The change from the nonlaminated and generally less resistant sandstones of the Mount Marion formation, with their marine fossils, to the laminated arkosic "bluestones" or graywacke flags (figure 46) that carry only fragments of land plants, is a marked zone, indicating

a change in the conditions of deposition. Although there are quarries also in the uppermost Mount Marion at Ruby, Highwoods and Unionville, the quarrymen recognize the difference in character of the beds and do not put the stone to the same uses. The interbedded shales change from blue to olive and more blocky, weathering reddish or brown so as to be suggestive lithically of the Upper Devonian "Chemung" facies beds in central and western New York, though lacking the fossils. These shales and flags constitute the first of the "continental" sediments in our area, and they differ from the overlying formation (the Kiskatom) only in showing no red shales. In fact, there is reason to believe that the line of division based on the local incoming of the red color is not a constant one across our area, but that the reds keep appearing lower down toward the north, especially where the line veers so suddenly eastward north of Kiskatom.

The converse of this is the retreat of this line southwestward from Highwoods to Zena and then to west of West Hurley (the relocated village) just off our map. The typical Ashokan flags lie south-southwest from West Hurley, around the east end of the Ashokan reservoir and in strike with the western part of this widened belt at Zena. Unless there are rolls in the strata that our field work has failed to discover, the typical Ashokan must be wholly or in large part represented by red-beds from Highwoods north, and what we are here calling the "Ashokan" throughout the same stretch must correspond to marine Hamilton beds above the Mount Marion at Stony Hollow and Bristol Church southeast of West Hurley, which are in strike with the eastern part of the flags at Ruby and with our "Ashokan" belt at Highwoods. The fossils in these beds at Bristol Church include, in addition to 14 species of the Mount Marion fauna, also the following not yet known in the Mount Marion (see Prosser, 1899, p. 296-97): (1) the trilobite, *Cryphaeus boothi;* (2) the pelecypods, *Palaeoneilo maxima, Prothyris planulata, Cypricardella complanata;* (3) the brachiopods, *Cyrtina hamiltonensis, Schellwienella chemungensis, Rhipidomella penelope?, Orbiculoidea* sp. "Storm-rollers" are conspicuous in this section.

Pebbly beds near or at the base of the flagstone series occur at Ruby and also on the road along the west side of Timmerman's hill, a half mile south of route 23-A, perhaps elsewhere. Darton (1894, page 494) reports "thin streaks of quartz conglomerate . . . at several localities interbedded among the flags, notably in the lower beds of the Jocky Hill region." Jockey Hill lies just south of the Saw kill, off our map, but in the same basal portion of the flags. These pebbles are suggestive of a disconformity between the Mount Marion and our

"Ashokan," (see Chadwick, 1927, p. 160). On the other hand, the behavior of the flagstone belt on the map, between Kiskatom and Vedder's hill, suggests that the continental flaggy facies may there invade the upper Mount Marion of farther south, at the same time that the Kiskatom reds invade the flags from above.

In short, the mapping of both upper and lower limits of the "Ashokan" flags has, for the time being, been necessarily done on lithologic features, which so often have proved misleading in these delta deposits with their facial changes; this mapping must therefore be accepted with caution, as also the use of the name Ashokan for the belt as depicted except at its southwest expansion.

The perplexity felt by writers over the identification of these strata is mirrored in the variety of names and correlations that have been employed.[1] In the dismemberment of the original Catskill Mountain series, which had included all our rocks above the Onondaga limestone, they at first passed as "Chemung," or else as "Portage." As early as 1894, however, Mr Darton (page 494) assigned them to the Hamilton; but in 1899 (pages 290-94) Professor Prosser identified them with the Sherburne sandstones of the Chenango valley in central New York, on the basis of supposed continuous field tracing and mapping. Returning to the belief in their Hamilton age, Doctor Grabau gave them in 1917 (page 954) the local name of Ashokan flagstones from the exposures and quarries around the Ashokan reservoir, especially those opened for stone for the Ashokan dam at Olive Bridge. It has remained for Doctor Cooper to show that these flagstones are lower instead of upper Hamilton, far below the Chemung (which actually does not reach our mountains' tops except possibly the summit of Slide far southwest of our area).

The thickness of the "Ashokan" flagstones in the belt from Highwoods to Kiskatom appears to be about 300 feet. At Zena, on the south, it is probably much thicker, approaching the 500 feet of the type section just over the edge of the map, and this by upward extension at the expense of the red Kiskatom. At the north edge of our map it seems to be thinner—in fact, has but little expression on the Cats kill, with no flag quarries north of Vedder's hill, but appears to lose itself in the downwardly encroaching reds near Puffer's corners (above Leeds, on route 23) where the highest marine fossils (spirifers) have but small thickness of flags between them and a heavy mass of reds. These uppermost marine sandstones are themselves very flaggy and nearly barren of fossils, in the Valje Kilje just under the highway, which now covers the exposures once visible beneath the old railway bridge.

The question of the exact age of our "Ashokan" is an interesting one, to which Doctor Cooper has not yet given us the answer. There is a chance that it may still be uppermost Marcellus (Cardiff) as Cooper concludes (1934, p. 5) "from thicknesses alone," namely Solsville and Pecksport (which we had thought to recognize in the upper Mount Marion). Other considerations suggest that it may be lower Skaneateles (Mottville, Delphi, perhaps Pompey, members), or that this may be the age of the type Ashokan if distinct from ours. That our belt may be partly each, Cardiff below and Skaneateles above, is hinted by a marked break or possible disconformity in these beds exposed by the roadside on the west of the Kaaters kill a mile or so north of High Falls, but any attempt to trace and map this break would be futile as there is no difference in character of the beds above and below it. Fossils do not help us. In the upper beds a half mile northwest of Quarryville one thin stratum of coarse sandstone in the roadway is filled with vertical burrows of the "worm" (phoronid?) *Scolithus,* indistinguishable in appearance from the familiar Scolithus beds of the Portage sandstones in western New York. In a brownish shale seam an inch thick in one of the eastern quarries near the base of the flags, a mile north of Quarryville, a tiny ostracod was obtained, a smooth form of no diagnostic value, but no other fossils save plentiful plant fragments. All these plants are of widespread Hamilton forms and give no aid in detailed correlation, though they are common everywhere in the flag series but mostly not so well preserved as in the upper Kiskatom and higher red-beds flags. Either they have been carried farther from their haunts, or they were less advanced and more fragile kinds; they seem in general to have been smaller.

Difficulty was experienced in mapping the basal limit of the flags on the west flank of the Hooge Berg peak at south end of Vedder's hill. The slope is strewn, far up, with loose masses of these beds, disrupted by the ice sheet. The expected (physiographic) boundary would follow the brook at the western base of this hill, where our line is drawn.

The only Ashokan fossils to be expected in our area are:

1 stipes of such plants as *Archaeopteris, Archaeosigillaria* and other forms listed under the Kiskatom flora, and rootlets(?) called "Psilophyton";

2 the (phoronid?) burrow, *Scolithus verticalis;*

3 the coiled burrow(?) described by Mather 1843, page 319, and named *Planolites clarkii* by Prosser 1899, pages 149-50, plate 6;

4 occasional ostracods.

Supplementary Note

[1] They are a part of division number "5. Grey grits and bluish shales, among which are the flag stones," of the Catskill Mountain series of Mather 1840, page 227, of which he states (page 232): "The stratum of flag stone is from 700 to 1,000 feet above the Helderberg limestone series." In Mather's detailed section in 1841, page 81, they constitute only No. 121 "Gray slaty grit, laminae of deposition distinct," whereas his overlying beds of "Gray slaty grit," No. 116-20, unknown to him actually contain and overlie red shales on the line of his section and are therefore mapped in our Kiskatom formation. It is these very beds, however, that may be the true Ashokan flagstones as above explained. In this table, Mather assigns no age, but by putting them next above the "Ithaca" of No. 122 leaves us to infer from his list on page 77 that they belong to the "3. Chemung group of Professor Vanuxem." On page 83 he says that this No. 122 "Ithaca to Marcellus" is probably 1,000 feet thick, and since (page 81) it constitutes a single "terrace" it is clear that it is the Mount Marion and Bakoven, not inclusive of any of the flagstone series. The same tabulated section, with the numbers of these beds raised by ten, is given by Mather in 1843, page 305, where No. 131 is our Ashokan, and the same comments apply. (See also pages 317-19). In Mather's six cross-sections on plates 45 and 46 (of 1843) we have a choice between "Ithica (sic) and Chemung group" on three of the sections and "Portage and Chemung groups" on the others, for the strata between his Erie division (Hamilton) and the red Catskill division.

Nevertheless, on the geological map of 1842 (and 1844) accompanying these final reports, the lower flagstone belt is included in the color for the Hamilton Group, while the Portage and Chemung color occupies practically the position of the Kiskatom red-beds. Mather's sections showing Portage and Chemung are copied.

Emmons in 1846, page 192 and plate xxi section 5, makes them "Chemung group" and lying directly upon the Hamilton, a succession accepted by Hall in 1859 (see pages 48, 51). In 1861, however, Ledyard Lincklaen referred them (page 68) to the Portage Group, in which he was followed by Hall in 1868, page 31. But in 1873 (page 7) and 1878, page 129, Hall put the "bluestone of the Hudson valley" into the Hamilton, a view that was apparently held by Professor Prosser as late as 1894 (page 56), was definitely that of Darton in 1894, as above noted (see pages 491, 494), who says they (his "Lower Flag series") are "in the main of the upper Hamilton group," and they were so mapped on the McGee map of 1894.

But in 1899, as noted, Prosser in his largely reactionary work, blinding his eyes to the significance of the facts he recorded, put these beds into the "Sherburne" of Genesee age (whose real equivalents are up around the Mountain House) on lithologic grounds, showing them on his map as "Ithaca and Sherburne" but naming only Sherburne in the text (pages 276-81, 289-98) with the explanation (pages 313-14) that the Ithaca had become red-beds included with the "Oneonta."

In spite of this, the Merrill map of 1901 labels them "Ithaca," though there is a chance that this was intended to cover the Sherburne as in Clarke 1903, page 24. Grabau in 1906, page 303, called them Sherburne, but renamed them as we have seen, in 1917, and corrected their assignment. See also Grabau 1919, pages 468-70. Like other aboriginal names, A-sho-kan really carries no accent, or an equal accent on all syllables, though the present tendency is to accent -sho-.

In their type area, south of ours, the Ashokan flagstones are given a thickness of 500 feet (Darton, 1894, page 491, also 494, misprinted "Upper Flag series") and are said to contain "several thin, discontinuous streaks of light greenish and reddish shales" in their upper part. Eastward increase of these reds on our area would put such strata into our Kiskatom, as before suggested. It is clear that our 300 feet of flags below the reds can include but a part, if any, of the type Ashokan.

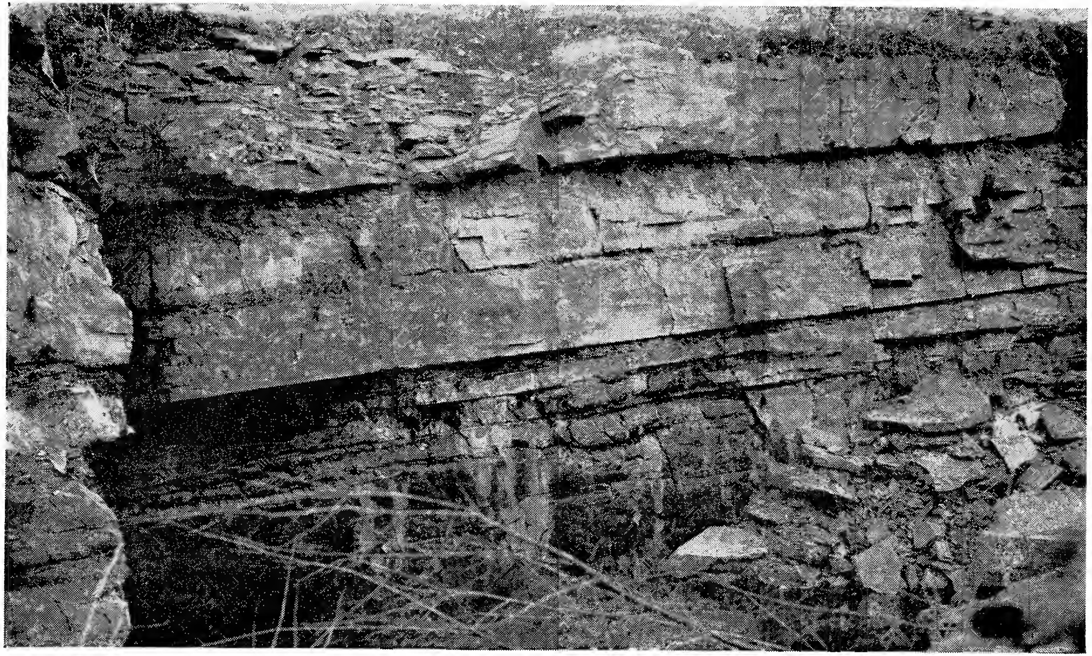

Figure 46 "Ashokan" flagstones at waterfilled old quarry southwest of Quarryville, furnishing only land-plant fossils. Shows low westerly dip and good jointing, with blocky shale seams. Looking northwest. Photo: April 1928, G. H. C.

Figure 47 Kiskatom red-beds at the "High Rocks," a postglacial chasm of the Kaaters kill in Kaaterskill clove, as seen from the Rip Van Winkle trail a mile west of Palenville. Middle beds (of about Ludlowville age). West dip about 3°. Shales are red. Looking north. Photo: April 1938, W. J. Schoonmaker.

16 KISKATOM RED-BEDS

The mile and a half in thickness of red-beds (figures 8, 9, 47, 77) that succeeds upon the "Ashokan" flagstones was formerly considered as wholly of Upper Devonian age and more or less indivisible, though occasionally someone glimpsed the idea that it might extend down into the Hamilton (Middle Devonian). As it constituted both the supporting plateau and the peaks and ranges of the Catskill mountains, it went under the comprehensive and ill-defined name of "Catskill formation" or Catskill group,[1] of which it must of course contain the typical expression.

Recent studies have demonstrated beyond controversy that these red-beds are not all of one age, and that they are subdivisible into members (formations) that may be traced continuously into definite members of the marine stratigraphic succession farther west in New York. The beds here termed the Kiskatom reds, with a thickness of certainly 2300 feet, prove to be of Middle Devonian, Hamilton, age.[2] They are, at least approximately, the beds formerly taken here to be the Oneonta, of Naples age (lower "Portage"), though early mapped as "Chemung."[3] Moreover, they are the beds to which the name "Catskill" was first applied among these Upper and Middle Devonian red strata.

The Kiskatom beds do not reach quite up to the rim of the Catskill plateau, while a fair portion of their thickness extends outward from the mountain foot into the Hudson valley (figure 77). Very characteristic of the Kiskatom belt, as indeed of all strata from the Mount Marion up, is the development of a succession of terraces, facing eastward in more or less vertical cliffs, with straight long fronts following master-joints, and with low westward dips beneath the next such terrace. Even on the steep mountain sides a light snowfall brings out the steplike flights of ledges (figure 5; compare frontispiece of Chadwick: Bulletin 307). These cliff or ledge faces have undoubtedly been much accentuated by glacial scrubbing and plucking and they run lengthwise of the ice flow. Each is commonly capped by sandstones or flags as gray as those of the Ashokan but often of coarser grain and more notably cross-bedded. Some of the sandstone is red, however, and banks of bright red shale nearly always bottom the cliffs.

A heavy bed of red shale in the lower part of the formation was formerly quarried in a large way on the east of Cairo Roundtop, north of our map, for the manufacture of vitrified paving brick in the now abandoned plant at Catskill village (all traces of which are fast disappearing). Quarries have been opened in the sandstones,

especially the flaggy ones, at many levels, both in the more easily reached ledges of the valley and in the almost inaccessible ones on the steep front of the mountain plateau. Almost none of these are in operation today. In these quarries, particularly those far up on Palenville Overlook, beds of a few inches filled with fossil plants occur and sometimes afford good material for study. The best collecting is usually in the quarry dumps. Fish remains must also exist, as they have been found in the neighboring Kaaterskill clove. On the quarry road up Palenville Overlook, at an elevation of about 1200 feet above sea, a large block was found containing a dozen or more well preserved and large specimens of the freshwater mussel shell, *Archanodon catskillensis.* The adjoining quarry yields a profusion of plant remains, including stems, straplike leaves and fruit cones.

Besides the land plants and the mussel already mentioned, and the "fish beds" reported by Sherwood (1878, page 347) in the lower part of the clove, the shales show many "fucoidal" markings due to burrowing worms of the ancient mud flats. In areas both north and south of our map, a zone in the lower part of our Kiskatom (but there just underlying the locally lowest reds) carries the little phyllopod crustacean *Estheria membranacea* and two tiny species of ostracods called "Beyrichia." (See Prosser, 1899, p. 257-59, 268; Clarke, 1901, p. 107, pl. 4).[4] The horizon of this zone should be well up in the reds near Palenville and is not likely to be discovered in such facies, probably passing farther west deep under cover in the mountains.

The cornstone layer reported by Mather (1841, page 81, No. 119; 1843, page 305, No. 129) as "Limestone, brecciated and conglomerate, two feet," has been found by me in or near the base of the Kiskatom beds a short distance northwest of Kiskatom (corners), and at that time looked upon as marking a possible disconformity in the bottom of the then supposed "Oneonta," (see Chadwick 1927, p. 160).[5] But cornstones occur at various levels in these continental strata, being thus without proved stratigraphic significance except that they are usually near the ancient shore line.

The fossils of the Kiskatom red-beds (see Mus. Bul. 307, page 91) have been listed for their whole geographic extent as follows:

1 the land plants, *Archaeosigillaria vanuxemi?, Sigillaria(?) gilboensis, Archaeocalamites inornatus?, Archaeopteris hallana, A. minor, A. obtusa, Eospermatopteris textilis, E. erianus, Rhachiopteroides punctatus, Psilophyton princeps;* the spore case, *Protosalvinia huronensis;*

2 the fresh-water pelecypod, *Archanodon catskillensis* (or new species?);

3 the "worm burrow"(?), *Planolites clarkii;*

4 the phyllopod crustacean, *Estheria membranacea;*

5 ostracod crustaceans, *"Beyrichia"* sp. (two kinds);

6 the "fishes," *Bothriolepis minor?, Dinichthys* cf. *tuberculatus, D. pustulosus, Sauripterus taylori(??), Holoptychius americanus?.*

Supplementary Notes

[1] It was only as it gained currency that this name became ill-defined in the minds of writers, widely extended over any beds of similar color in the higher Devonian and bandied about in its home ground. The original definition was the most clean-cut of any formational description that appeared in the early writings and is a model to follow today. The history of this name "Catskill" is given at great length in N. Y. S. Mus. Bul. 307 (Chadwick, 1936) in order to relieve this present report of a prolix discussion.

[2] As far back as 1885, Hall (p. 517-18) considered (see also his tabulation) that the Oneonta reds embraced down into the upper Hamilton, which is not true, however, for the typical Oneonta. In 1900 (p. 594), H. S. Williams said that in eastern New York "as low as the horizon of the Hamilton fauna the sedimentation assumes the arenaceous and sometimes the reddish character of the typical Catskill rocks." In 1902 (p. 420): "The Catskill formation begins at the horizon of the Hamilton in the eastern sections." And in 1910 (p. 285), he says of Catskill sedimentation: "In eastern New York it began while the Hamilton marine fauna was still present and cut it off, bringing in estuarine conditions with a brackish water and land fauna and flora."

The differentiation of these Hamilton red beds, with proposal of the name Kiskatom, was made by Chadwick in 1932, p. 7, as reprinted in Chadwick 1936, p. 72. This was further amplified in Chadwick 1932(*a*), p. 12, 77; 1933, p. 86-87; Chadwick and Kay 1933, p. 4, 6-7; Chadwick 1933(*a*), all; 1933(*b*), p. 102-3; G. A. Cooper 1934, p. 5; Chadwick 1934, p. 11; 1935, p. 134 figure; 1935(*a*), p. 822; (*b*), p. 857; Chadwick 1936 (use index). The name is pronounced kis'ka-tom.

[3] The Kiskatom and Kaaterskill constitute the original "Catskill division" of Mather 1843, p. 299-316, technically preceded by Vanuxem's "Catskill group" of 1842, p. 186-94, also p. 16, which we now know does not correspond or even overlap with Mather's Catskill. On the 1842 (1844) geological map, however, essentially the whole Kiskatom is mapped as "Chemung" and the Catskill color is confined to the higher rocks that Mather had assigned (p. 303) to the "Coal formation" (Pottsville conglomerate). Ashburner 1888 also maps here a belt of "Chemung." Hall in 1863 (p. 108; see also 1862, p. 381) definitely assigned these red beds "below the elevation of the Mountain House" to the Chemung. In general, though, the name Catskill stuck to these beds as well as the overlying ones in spite of some recognition of supposed Chemung equivalency. But in 1885 (p. 518), Hall decided that the Chemung had thinned to nothing in the Catskill front, assigned these lower reds to the "Oneonta" and asserted a mixed upper Hamilton and "Portage" age for them. The name "Oneonta" then adhered to them until that of Kiskatom was proposed (1932).

[4] This zone has been traced by me over a considerable area east of Oak Hill and has been found by Doctor Ruedemann as far north as Rensselaerville, at the falls. It recurs with exactly the same expression and contents near the aeration plant at the Ashokan dam, but there has reddish beds below it in what might be considered the top of the Ashokan according to Prosser's mapping. *Estheria membranacea*? was collected by me also in the old summit cut of the Delhi and Andes Railway grade in the western Catskills, a very much higher stratigraphic position.

[5] See Chadwick 1927, p. 160. Mather (1841, p. 83; 1843, p. 307) says that this bed "is found over a great area in the Catskill mountain region, although rarely more than one foot thick," and that "it is a good reference stratum."

He further states (*ibidem,* and 1840, p. 228; 1843, p. 314) that it carries small quantities of metallic ores "in various parts of Greene, Ulster, Sullivan and Delaware counties, but the stratum was nowhere more than eighteen inches thick. It was generally a calcareous conglomerate or breccia, formed of small masses of limestone, imbedded in a reddish or brownish paste of the underlying shale bed.* / *This stratum, when exposed to the weather, becomes more or less porous and cellular, from the solvent action of the water upon the calcareous ingredient. Considerable quantities of it are seen scattered over the fields and it has acquired the name of *firestone* in some of these counties, in consequence of its resisting the effects of common fires, not cracking to pieces." Cornstones in the red beds are reported also by Vanuxem 1842, p. 186. The distribution reported shows that they are at no one constant level. The source of the lime that they contain is an interesting problem.

17 KAATERSKILL SANDSTONES

Rimming the steep trench of the Kaaterskill clove in heavy ledges (figure 50), making both the Kaaterskill and Haines' falls and extending thence to the Mountain House and beyond to the nearer ledges on North mountain (Artist's rock, Prospect rock), is a group of three sandstones or flagstones (figure 48) of the usual "Catskill" type, gray to reddish in color and often with some white quartz pebbles. Red shales up to 50 feet thick are interlarded (figure 49). The series terminates upwards against a heavy (pebble or cobble) conglomerate that may bear slightly unconformable relations to it. To this series of beds, with a provisional thickness downward of about 250 to 300 feet, Dr Bradford Willard has given the highly appropriate name of Kaaterskill sandstones. It is our present belief that these strata are of the age of the Tully limestone of central New York. (See Willard, in Chadwick, 1936, p. 74.)

These beds, with the conglomerate overlying them, rim also the Plattekill clove and in fact they are the rimrock of the whole eastern front of the plateau, capping the quoin of the steep drop into the Hudson valley on all the spurs. Tracing of them across the southern stretch, from Overlook mountain westward, is not so easy and may not have been done correctly. The suggestion of unconformity is found in both of the cloves, the vertical interval between the conglomerate and the rimrock appearing to increase westward towards their heads. Although the mapping has been done on the base of the conglomerate, it is possible that this increment belongs with the Onteora rather than with the Kaaterskill. In view both of the now demonstrated relation of the Tully to the Hamilton, as Middle Devonian, and of the uncertainty as to the division line locally, the Kaaterskill is mapped by us along with the Kiskatom, just as Mather united these.

The fossils of the Kaaterskill have not been studied. Plants are present, of course, but poorly preserved. In my boyhood I found near the Laurel House, loose below the level of the conglomerate, but did not retain, an aviculoid shell (probably an Actinopteria) that may

Figure 48 Kaaterskill (Tully?) sandstones at the famous Kaaterskill falls, showing full amount of short post-glacial gorge. Remnants of winter ice. Note great irregularity of bedding and rapid alternation from thick red shale to massive gray sandstones. Looking north of east. Photo: April 1915, G. H. C.

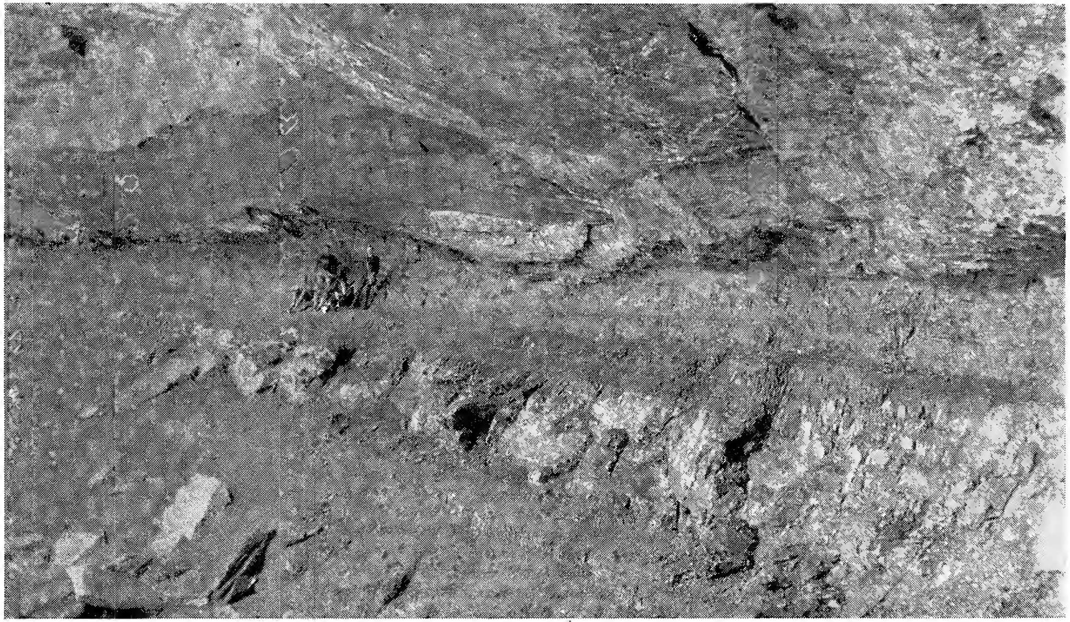

Figure 49 Thin bed of red shale, high enough for path, beneath middle Kaaterskill sandstone at the Kaaterskill falls. Shows roof spalling and the irregular contact of the gray sandstone upon the red shale. The sags of the sandstone are pebbly. Vertical drip-marks in the rotting shales. Looking north. The roof projects about 70 feet! Photo: April 1919, Atwood G. DeCoster.

have come from the outcrop. Inasmuch as both the Tully and the overlying Sherburne ("Ithaca") are filled with marine fossils no farther away than Hardenburgh falls, Gilboa and the Manor Kill valley (see Cooper 1933, p. 541, 544; 1934, p. 7, 8; not likely true Ithaca), some stray shells may yet be found here in the most unlikely looking rocks at these horizons. Similarly, pelecypods and even brachiopods have been discovered in the midst of the Kiskatom red-beds and in typical flaggy to pebbly "Catskill" sandstones as far east as Durham and Cornwallville, on the quadrangle next north. The search is worth making.

18 ONTEORA RED-BEDS

Rough tracing of the base of the Upper Devonian around the north end of the Catskill mountains from Gilboa (in the Schoharie valley) via the Manor kill, together with expected thickness increase in the Hamilton beds, has led to the recognition of the "puddingstone" conglomerate or "third ledge" above the Catskill Mountain House as the probable commencement of Upper Devonian sedimentation here. This is the point that Mather in 1843 (page 303), mistaking the puddingstone for the Pottsville conglomerate at the base of the Coal Measures, made the top of his original Catskill division. It is the point selected by Hall in 1863, page 108,[1] for the bottom, instead of the top, of the Catskill group, the reds below being correlated with the marine Chemung. In 1885 (page 518), having decided that the Chemung failed to reach the Catskill front, Hall made it the line between the Catskill above and the Oneonta below. The former was presently correlated, in turn, with the Chemung, (Darton 1893). The successive shifts in the supposed ages of the beds above and below this line may be tabulated thus:

Mather 1843	*Hall* 1862-63	*Hall* 1885	*Darton* 1893	*Chadwick* 1934-36
Pottsville	Catskill	Catskill	(Chemung) note	Genesee (Onteora)
Catskill	Chemung	Oneonta	(Portage)	Tully (Kiskatom)

Thus these writers picked here what seems to be the most marked lithologic break in the stratigraphic succession across this interval. But this was not the tracing of Darton (1893, page 207), who brought his Chemung around below the "red shale bed 25 to 30 feet in thickness" next under the Mountain House ledge, and carried its base about 250 feet lower, or about 490 feet lower than the conglomerate. From Sutton's gap southward along the Catskill front Darton's "Chemung" was, however, actually uppermost Hamilton (upper Moscow); therefore his bringing it just under the Kaaterskill (Tully)

beds checks almost exactly with our own tracing, in this same stretch. Darton's line, 340 feet below the Mountain House, was adopted on the 1894 and 1901 geological maps of the State.

From the base of the conglomerate up to the base of the heavy Stony Clove sandstones there is a vertical interval of about 1100 to 1200 feet, and from the base of the Stony Clove beds to the base of the white Slide Mountain conglomerate there is an interval of about 3000 feet. To these two subdivisions of the "Catskill" of Hall and later writers have more recently been applied the early names for these mountains, the aboriginal name of Onteora (figures 50, 52, 59) to the lower division, the Dutch name of Katsberg to the higher one. Regardless of what happens to the much disputed name Catskill, a misnomer for the mountains in any event, these earlier and more correct names are available for its stratic members (see Chadwick, 1936; 1933, p. 482-83, for history of these).

The Onteora red-beds differ little from the Kiskatom red-beds except for the incoming of substantial conglomerates, especially at base[2] (figure 51), and the somewhat larger proportion of sandstone and the lesser amount of shale. So far as known the shale is always red, containing none of the occasional blue-gray (marine?) or even the green layers that occur in the Kiskatom. Quarriable flagstones continue upward throughout the Onteora, (see H. T. Dickinson 1903, plate 2, map), and have been worked to the summit of Plattekill mountain.

The 1150 feet (more or less) assigned to the Onteora formation is not as much thickness as would be expected here for the equivalents of the combined Sherburne (Genesee) and Oneonta (Ithaca) formations, if these beds thicken eastward as do the other members in this delta deposit. Possible alternative correlations will be discussed under the Stony Clove sandstones. It will be well, nevertheless, to consider at this time the nature of the contact between Middle and Upper Devonian across New York State. From Central New York to Lake Erie this contact exhibits a markedly disconformable relation; the underlying Tully limestone is cut out westward and then parts of the upper Hamilton are pared away, while the overlying Genesee loses eventually all of its thick bottom member (Geneseo black shale) and thus the middle Genesee (Genundewa limestone) comes to rest on a level some distance down in the Moscow shale of the Hamilton. Eastwardly the Tully persists and thickens into sandstones (Gilboa, Kaaterskill), but according to Doctor Cooper the 300 feet of Geneseo and Sherburne at Ithaca (after thickening in the intervening territory) have dropped to 206 feet of Sherburne in the Susquehanna

Figure 50 Kaaterskill sandstone rimming Kaaterskill clove on north side at Sunset rock (seen from east side). Doctor Alling on brink. Kaaterskill clove below, with the corresponding ledge on far side at left. Haines' falls, where this layer crosses at head of the clove, concealed behind tree in middle. East peak of East Jewett range in background, with Parker (Onteora) mountain to right, and Colonel's Chair of Hunter mountain faint to left. Looking west-northwest. Photo: April 1919, A. G. DeCoster.

Figure 51. Twilight Park conglomerate in Twilight Park, one-half mile southeast of Haines' corners, Haines' Falls. The steps have been built up through a natural joint crack. Looking southeast. Photo: April 1938, W. J. Schoonmaker.

valley. In that case, the entire Sherburne might disappear from the section before reaching the Catskill front; whereupon the Onteora would consist wholly of the Oneonta and this would fit closely to the expected thickness here of that formation alone. But the small wedge of sandstones that seem to intervene between the Kaaterskill and the conglomerate at the upper ends of the two cloves might be the feather edge of the Sherburne.

From the new road cut west of Beach's corners, in the northwest corner of our map, came the block of rock with excellently preserved stems of the early tree, *Archaeosigillaria primaeva* ("fossil snakes") that now supports the bronze tablet at the Catskill end of the Rip Van Winkle bridge. This plant was originally described from the "Genesee" beds of Pennsylvania, of nearly the same age as our Onteora beds that furnished this block. Rather finely preserved plant material has also been obtained from the quarries on the east end of Mt Zoar at East Windham, about seven and one-half miles northeast by north from Beach's corners, which are at a lower level in the Onteora and presumably are Genesee (Sherburne) in age. There is still much work to be done in collecting and studying the flora and fauna of the Onteora beds. The list that follows represents all that has been published on the entire area occupied by both Onteora and Katsberg divisions with also all land plants found drifted into their marine equivalents. Complete separation of the lists from these two formations is not possible at this time on account of indefiniteness of locality and horizon on a number of the reported finds. Those found *only* in the Genesee (Sherburne) portion of the Onteora are starred. (See Mus. Bul. 307, page 91.)

There may be expected in the Onteora and Katsberg beds:

1 the land plants, *Archaeosigillaria primaeva, A. vanuxemi, A.? gaspiana, A.? simplicitas, *Cyclostigma affine, *Archaeocalamites inornatus, Protosalvinia huronensis* (spore cases), *Archaeopteris jacksoni, A. halliana, A. obtusa, Asterochlaena noveboracensis, *Cladoxylon mirabile, Eospermatopteris* sp., *Psilophyton princeps, P. robustum, *Rhachiopteris tenuistriata, *Rhodea pinnata, Rhachiopteroides punctatus, Cordaites clarkii, Dadoxylon* sp., *Hormoxylon erianum;*

2 the "fishes," *Holoptychius americanus, H. halli, Sagenodus fleischeri, Holonema rugosum, Dinichthys pustulosus, D.* cf. *tuberculatus, D.* cf. *curtus, Onchus rectus, Bothriolepis nitida, B. minor, Cephalaspis* sp.; (a part of these are true fishes);

3 the huge eurypterid, *Stylonurus excelsior;*

4 the phyllopod crustacean, *Estheria membranacea?;*

5 the freshwater mussel, *Archanodon catskillensis.*

Supplementary Note

[1] In 1862 (p. 380) Hall said: "I am inclined to believe that until we ascend the slopes of the Catskill mountains and rise to an elevation of at least 2000 feet above tidewater, we find no rocks of newer age than the Chemung group." And in 1863 (p. 108): "The term 'Catskill group . . .' . . . is not at all applicable to any beds in the Catskill mountains below the elevation of the Mountain House."

[2] This is The Twilight Park conglomerate of Prosser (1899, p. 238-84).

19 STONY CLOVE SANDSTONES

The deep and constricted pass of the Stony clove is walled on both sides with precipices of gray sandstones (figure 76) coarsely flaggy and without noticeable trace of red color through a thickness of eight or nine hundred feet. These beds (figures 52-55, 71, 76) have a marked physiographic effect. Viewing the Catskills from the Rip Van Winkle bridge or for some miles around it, the outlines of the mountains are seen to be mostly rounded. Four or five peaks furnish conspicuous exceptions: Indian head (figure 4) with its three south-facing cliffs that make chin, nose and eyebrows, Kaaterskill High peak and its companion Roundtop (figure 5) again with south cliffs on summits that give sawtooth profiles, similarly Stoppel point and finally the sharp south drop on the dome of Blackhead (figure 6). In each case these mountains are capped and these cliffs are formed by the Stony Clove member, though it has taken us a century to recognize this simple fact. Now that the idea of perfect horizontality of strata in our mountains has given place to perception of the actual dips, it is easy to follow these beds with the eye (figure 54) southeastward from the Stony clove along the escarpment of the central range till they cap Indian head but shoot over the top of Plattekill mountain, and similarly to pick them up eastward on the East Jewett range and the summit of the High Peak-Roundtop range (figure 52), northward in the Colonel's Chair of Hunter mountain.

Opportunity was lacking for adequate field tracing, but because of their color, lithology, proper expected thickness and general position in the succession, the Stony Clove sandstones have been taken to be the continuation of the Kattel gray flagstones of the region eastward from Franklin, Delaware county, New York, the beds that Darton correctly traced as "Chemung" on through to Delhi while they carried fossils, then missed the dip and stepped down off them before reaching Prattsville. The possibility that the Stony Clove beds may really be the next lower formation, the Oneonta, and so belong with the Onteora, is discussed under the Katsberg member beyond. For purposes of mapping it is easier to draw the line at their base than

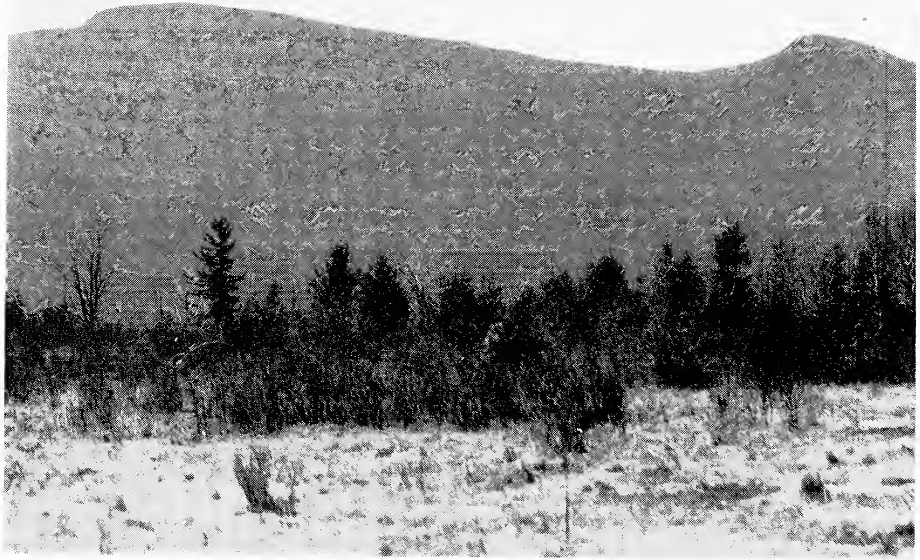

Figure 52 North slope of High peak and Roundtop (Mt Lincoln) above the Kaaterskill clove (which, a thousand feet deep, lies hidden in front) on which slope lies type section of the Onteora red-beds. Peaks capped by Stony Clove sandstones. Visibly west dip. From near road corners one and one-half miles east of Haines' Falls, looking south-southwest. Photo: April 1938, W. J. Schoonmaker.

Figure 53 Stony Clove sandstones on east ("south") side of the Stony clove and making the full height of the steep slope (lower part covered by talus in the view but exposed in rear of camera). (See figure 76.) Looking northeast. Photo: Novemebr 1936, E. J. Stein.

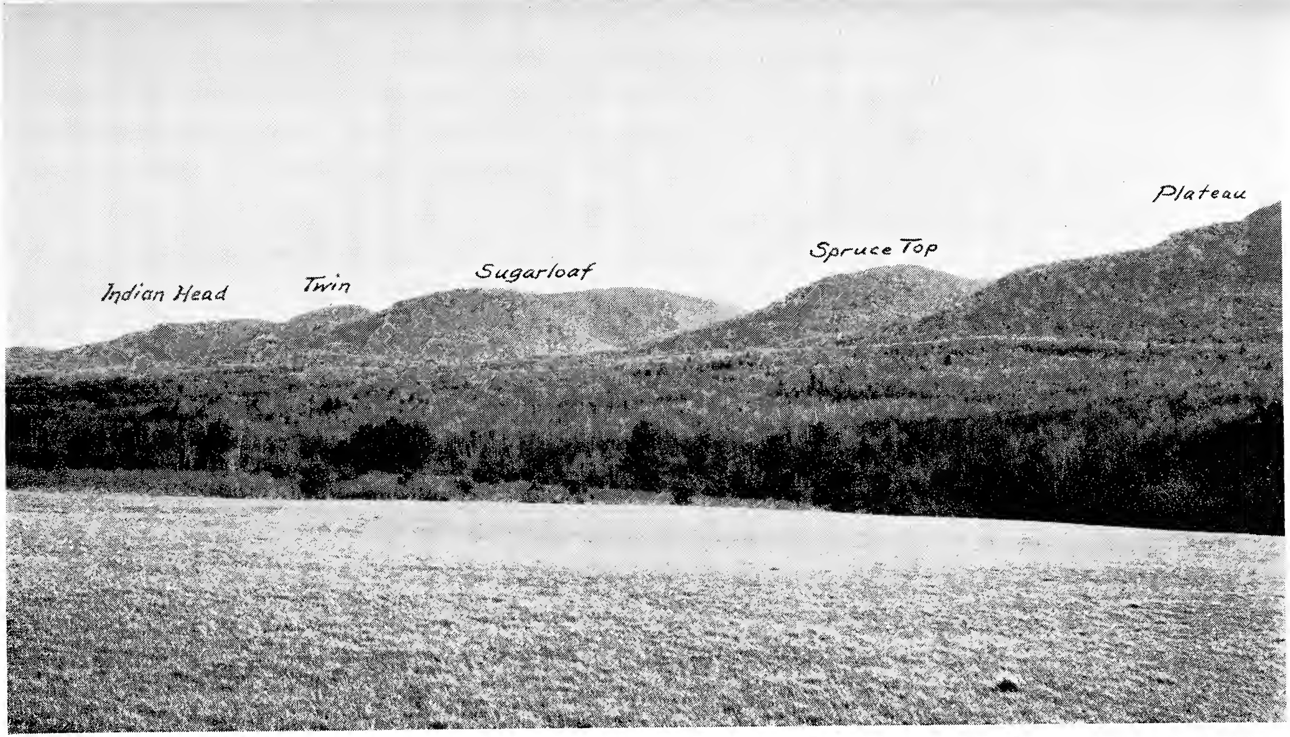

Figure 54 Stony Clove gray sandstones (underlaid by Onteora, overlaid by Katsberg red-beds) making steps in the smooth slopes of the peaks of central range of the Catskill mountains, and rising slowly left (southeast) into the summit of Indian Head mountain. Spruce Top is only a spur of Plateau. Looking south-southeast up south fork of Schoharie kill toward Elka Park (center) from Rip Van Winkle trail about two miles west of Tannersville. Photo: November 1936, E. J. Stein.

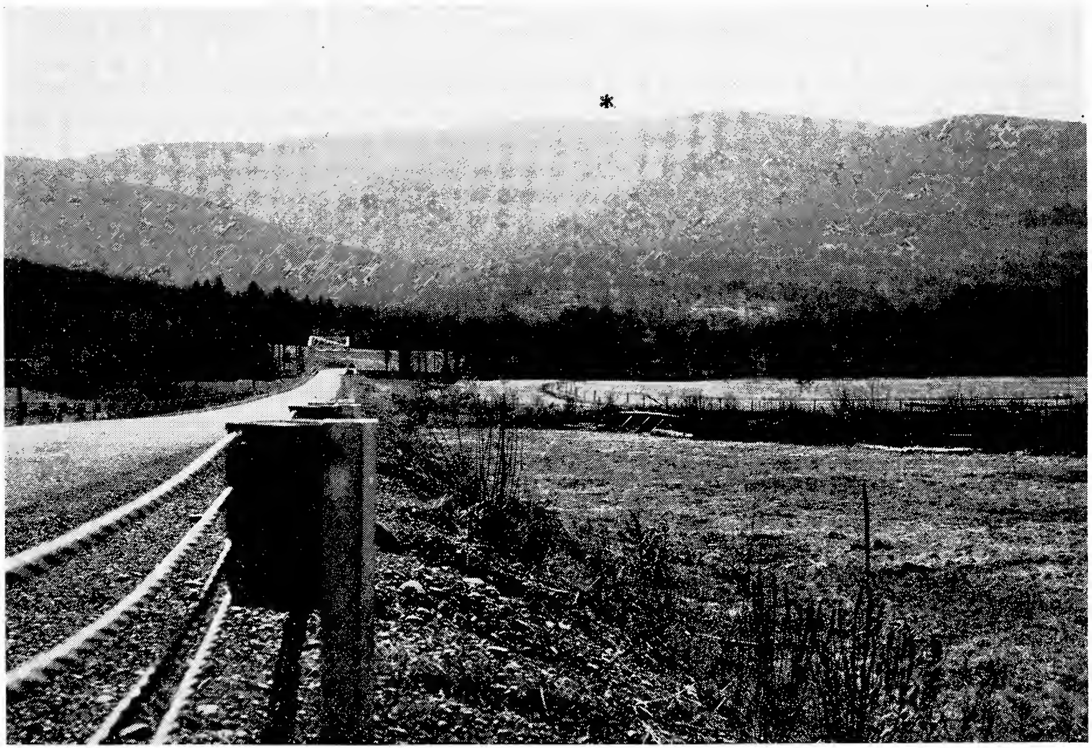

Figure 55 Katsberg red-beds making the great dome of Hunter mountain (4025 feet). Near spur on right (out of perspective) terraced by Stony Clove sandstones forming the pediment of the mountain. Amphitheater developed by arborescent drainage simulating a circ but without circ characters. Asterisk marks position of fire tower, too faint to appear in the half-tone. View west-southwest from start of route 214 near junction with Rip Van Winkle trail two miles east of Hunter. Photo: April 1938, W. J. Schoonmaker.

at the somewhat indefinite summit, and thus to include them in the Katsberg as its basal member, expressive of our present understanding of their relations.

In the quadrangles westward, a zone of high-grade flagstone quarries appears to follow the Stony Clove outcrop and to tie this in with the Kattel flags, but in our area the beds seem to be too coarse for economic use and are not worked, as far as I have ascertained.

Little is known of the fossils of the Stony Clove sandstones. Some of the plants in the list given for Onteora and Katsberg should be present.

20 KATSBERG RED-BEDS

The highest layers on our area are those on the summit of Hunter mountain (figure 55), our highest peak and the second highest of all the Catskills. Here, in the trough of the gentle syncline, there are about 1250 feet of beds on top of the Stony Clove sandstones which are unquestionable Katsberg, but these beds fall at least 800 feet short of reaching the summit of the formation as it is seen on Slide mountain, 15 miles southwesterly. (See map figure 4 in Mus. Bul. 307.) The white-looking and pebbly beds on the top of Hunter belong to the Wittenberg conglomerate member of the upper Katsberg, a remnant of which also caps Plateau mountain and has helped to preserve its crest. These "white" beds are in the Pocono facies and have been called "Pocono" by writers[1] but are older than the Pocono beds of the Pocono mountains in northeastern Pennsylvania.

Although the Katsberg formation is here called "red-beds" (which it actually is farther west), there is very little red in it on our area. This absence of abundant red color from the higher part of the Catskills has troubled many observers, and it has been one of the reasons for their thinking that later rocks here supervened upon the Catskill. The explanation will be brought up in a later chapter. But it is nevertheless true that some red shales do occur, especially just above the Stony Clove member, and that there are large thicknesses of them again in the upper beds of the Katsberg that are missing on Hunter but present in the top part of Slide mountain. The percentage of red shale in the successive members of the red-beds series is found to diminish progressively upwards, the Kiskatom containing the most red color and the Katsberg the least, so far as the local expression of these beds is concerned.

Gray to "white" sandstones or flagstones, in thicker and thinner layers, therefore make up most of the Katsberg on our area, with small amounts of red shale and red or reddish sandstones. Quartz pebbles are common, especially in the "white" layers. Fossils are

few, chiefly poorly preserved land plants. The list of expected forms is that already given under the Onteora member.

In our present understanding of the Katsberg as including the Stony Clove sandstone for its basal member, the formation has a thickness where complete of about 3000 feet. The portion above the Stony Clove member is lacking in good flags. Its sandstones are heavy, coarse, likely to be pebbly and sometimes reddish. They are comparatively inaccessible and have not been quarried. The Katsberg forms a large part of the central range, especially the part north of figure 54.

The question of correlation, twice mooted previously in these pages, can not be settled without further field work to northwest and west. The method of expected thickening (at the rate of 1½ per cent per mile to southeast, compounded) that has proved so useful for predicting in western and central New York seems to confirm the Kattel age of the Stony Clove and the Oneonta age of most of our Onteora, with wedging out of the Sherburne. This is brought out in figure 56.

In viewing this figure it is necessary to keep in mind that the sections are not drawn to a uniform scale, but each is enlarged to what it would be expected to increase to by the time that the beds reached the Catskill mountains of our area. The rate of increase is figured at 1½ per cent per mile for the Upper Devonian and 1 per cent per mile for the Middle Devonian except at Ithaca; there the 1½ per cent is used for the Middle Devonian also in order to offset the sudden swell in the Cardiff east of there. In the Oneonta column two sets of measurements are used: on the right, 600 feet of Sherburne and 500 feet of Oneonta; on the left, 206 feet of Sherburne (Cooper's figure) and 700 feet of Oneonta (expectation from Ithaca would be 770 feet of Oneonta and 440 feet of Sherburne). On the basis of these two sets of measurements, two interpretations become possible for the beds above the Tully and are shown by solid line for the one presented in our text and in broken line for that suggested as alternative.

It will be seen that the general correspondences of expected to actual thickness at Catskill section are fairly close but that if the Kattel becomes the Stony Clove (solid lines), using Cooper's figure for the Sherburne, then the latter should actually wedge out at the east as we have previously considered likely. On the other hand, if we believe (broken lines) that the Sherburne makes the whole of the Onteora up to the Stony Clove beds and that these are the Oneonta, we are confronted with the difficulties higher up, first that

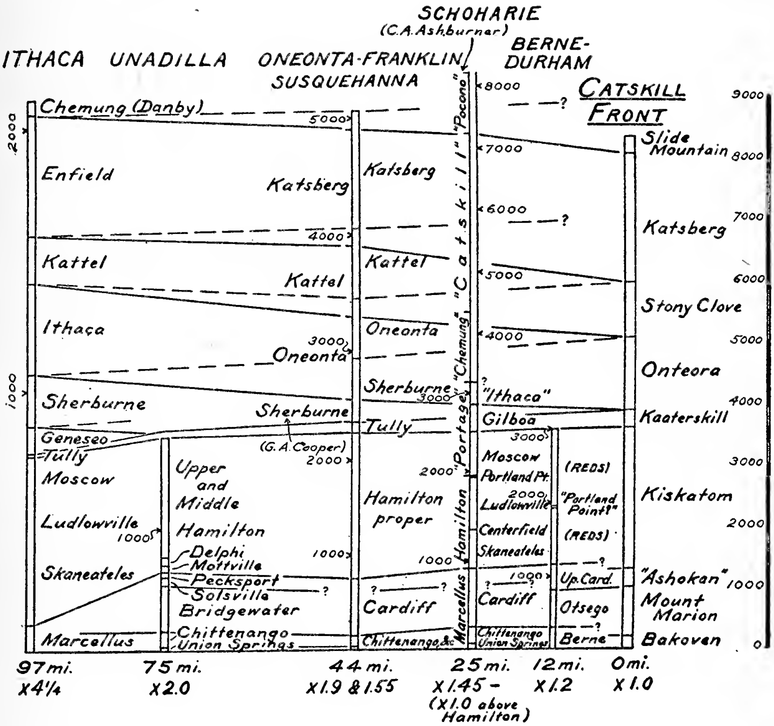

Figure 56 Alternative correlations in the Upper Devonian (Senecan) beds of the Catskill Mountains as suggested by the principle of uniform thickening eastward. Distances obtained by projection upon a line N. 45° W. In Senecan beds 1½ per cent per mile increment used and also for Hamilton at Ithaca; otherwise 1 per cent in Hamilton. The chart does not actually demonstrate any correlations, especially in the Hamilton, and serves merely as a *point d'appui.*

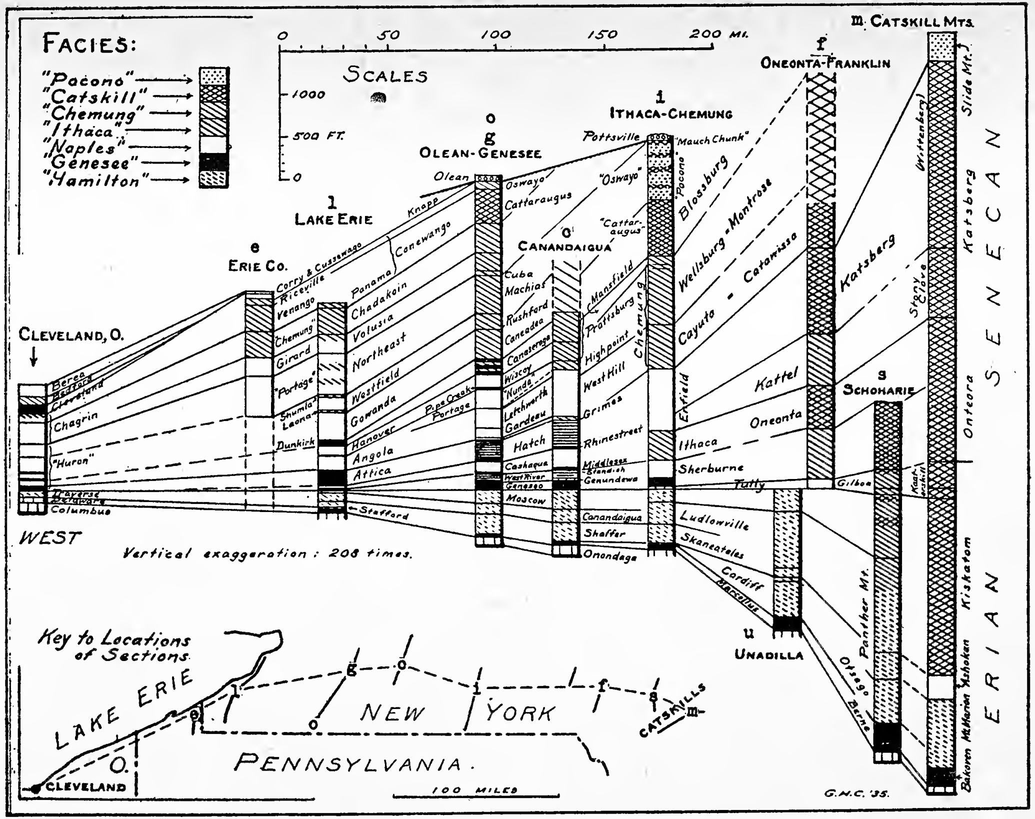

Figure 57 A chart showing progressive thickening and facies changes from west to east in the sediments of the "Catskill delta." Reproduced without revision from New York State Museum Bulletin 307, page 99.

there is there no recognizable Kattel equivalent and second that the disconformable relations are merely shifted up to the Enfield-Chemung contact. Nevertheless, a small break is known at that contact in western New York, cutting out the Grimes sandstone. Therefore the chart still leaves us with the question open.

The Schoharie section (from Cooper) has been checked against Ashburner's old measurements through his "Portage" and then continued upward on his actual figures without enlargement, because of geographic convergence of the section to ours. His 1000 feet of "Pocono" is of course too much.

Supplementary Note

[1] It will be recalled that Mather (1843, p. 295, 303) and Emmons (1846, p. 195, 367) hesitated whether the (Pottsville) conglomerate of the base of the Coal Measures occupied our mountain tops. Their remarks seem, however, to have been taken by Lincklaen in 1861 (p. 70-71) to refer to the Pocono which (identified by its being succeeded by the "Umbral" or Mauch Chunk) he now makes "the base of the great Carboniferous system" and this is in agreement with Hall in 1859 (p. 52-53) who referred the Catskill also to the "great Carboniferous limestones" (Mississippian period). In 1883 (p. 65), Hall speaks of "the Catskill, including the upper member or Pocono sandstone," in which he was preceded by J. P. Lesley in 1882 (p. x): "The peaks are what remain of the overlying Subcarboniferous, Pocono formation." (See also Ashburner 1888, p. 954; Lesley 1892, p. 1567; who assign 1000 feet at top of our mountains to the Pocono.)

FACIES CHANGES ON THE RED-BEDS DELTA

It was formerly supposed that the Upper Devonian strata of New York consisted of four successive formations each with a characteristic lithology and fauna or flora, namely, the *Genesee* black shale, the *Portage* olive shales and thin sandstones or flagstones, the *Chemung* brown-weathering sandy shales and sandstones and the *Catskill* red shales and interbedded sandstones or heavy flagstones. To these in Pennsylvania and also, some thought, in the Catskill summits was added a fifth deposit (Devonian or Mississippian as the author might choose), the *Pocono* "white" sandstones and conglomerates. Although lateral transitions of these five kinds of deposits into one another were repeatedly observed and reported in the literature, they were still relied upon for correlation and believed to be of five distinct ages, in the order above given, with the Genesee the oldest. From central New York westward into Ohio there were many sections where these five types of beds could be found succeeding one another upwards in proper succession and this was taken as conclusive evidence.

But there early began to be doubt as to the red-beds, the "Catskill." It became evident that this type of deposit, at least, interfingered

with and passed laterally into marine beds ("Chemung") of contemporary age and even into marine beds as old as the "Portage" east of Ithaca (the Oneonta red-beds). (See Hall 1862.) Half a century ago the discovery was announced that the "Chemung" beds overlying these Oneonta reds were the changed eastward extension of the pre-Chemung Enfield beds (name not then proposed) of the Ithaca section, there classed as "Portage." (See H. S. Williams 1886.) Just previous had come the soon-forgotten proof that the true Portage sandstones are of Chemung age (see John M. Clarke 1884, pages 21-22, and 1885, page 67) which startled the conservatives when reasserted on fuller evidence recently. (See Chadwick 1935, page 343.) Even before that, the lateral passage of "Catskill" reds into "Pocono" ("whites") had been noted. (See H. M. Chance 1880, page 114.) The great thinning of all these deposits westward, and the passing of "Portage" beds into black ("Genesee") shales in Ohio, had also gained general acceptance.

Long continued field work eventually showed that all five of these types of sediments were laid down contemporaneously on a great land delta and its underwater (marine) extension westward. The coarse "white" beds called Pocono were those far up toward the delta head. The red muds did not lodge much there but were swept on down and spread out between the flaggy sands of the main delta surface to make the "Catskill." What continued out under water lost its red color by organic reduction of the red ferric oxide in a shallow and warm "littoral" zone where life was abundant, and this part constitutes the "Chemung." Finer stuffs floated in suspension into deeper colder waters farther from shore, where frail things lived in the chill depths, and this is our "Portage" sediment. At the most remote point, organic material was the main accretion—the black "Genesee." (See the chart, figure 57.)

The apparent superposition of these deposits came about through the building of the delta westward, just as the Mississippi has built all the way from Illinois down and out into the Gulf. Inevitably, then, each zone, with its own type or "facies" of sediment and of life-forms, gradually overlapped westward the next outward zone, until the latest "Pocono" far overreached the earliest "Genesee." For these matters took many millions of years and meantime life was changing, evolving, so that only a few of the most hardy forms carry through, in sediments of like facies, but being abundant these were supposed to prove age identity until the whole faunas of the beds at different points were analyzed and the very significant age differences made evident. (See Chadwick 1935*a*.)

FORMATIONAL CONTACTS

The outstanding general feature of our Silurian and Devonian rocks is their parallelism, their maintenance of uniform thicknesses across the entire area. Continuity of deposition is the natural inference—a quiet and stable sea, receiving formation after formation without break in the record. But there are certain exceptions already noted, especially in the Rondout and Glenerie beds, at local base respectively of the Silurian and (possibly) the Devonian. More searching examination of the formational contacts reveals evidence that deposition was not thus uninterrupted. Sharp changes in lithology (often also in fossils) can not well occur without disturbance of the conditioning factors (climate, currents, lands and seas) that doubtless was never so "sudden" as it appears. Time was lost, the record broken.

Much longer known is the break between these rocks and the Ordovician rocks beneath them, which will be described first.

THE BASAL UNCONFORMITY

Mention has been made (page 45) of the encroachment of the Silurian sea upon an eroded land surface of the older rocks. The returning sea brought late Silurian beds to rest upon early Ordovician ones in the Hudson valley, whereas in central and western New York a great thickness of other rocks intervenes, the section is nearly complete and the line between Ordovician and Silurian strata barely discernible in the midst of red beds (Queenston-Medina). The formations present (between Watertown and Syracuse, for example) but lacking in our region at the Normanskill-Rondout contact are as follows:

	Maximum thickness in New York
Cobleskill limestone (probably)	10
Bertie waterlimes	60
Camillus shale	400
Syracuse salt and shale	100
Vernon shales	500
Lockport limestones	170
Rochester shale	100
Clinton beds	150
Oneida conglomerate	50
Medina sandstone	120
(Total Silurian missing: 1660 feet)	
Queenston red shale	1200
Oswego sandstone	100
Lorraine shales and sandstones	900
Utica shales and limestones	800
Trenton limestones	350
Black River limestones	150
(Total Ordovician missing: 3500 feet)[1]	
Total thickness	5160

The loss of these beds eastward is by a double procedure: The upper and middle Ordovician strata are gradually bevelled away as far east as the vicinity of Rome, N. Y., where they are slightly upturned and cut off more rapidly for a space, steadily thence eastward to the Helderberg front. The Silurian beds, on the contrary, fail from bottom up, as they come east, losing first the lower and then the middle members. The loss of the Ordovician rocks is thus clearly by erosion and removal of strata once present; that of the Silurian, by failure to lap on against a land whose shore line was gradually shifted eastward as the sea transgressed. Naturally, erosion continued to operate longest in the part last to be submerged, the east.

Coming around the Helderberg salient, the Manlius rests directly upon rocks of Utica (Frankfort) age, though both east and west the topmost beds of the Ordovician are of the still older (Trenton) Schenectady formation. But southeast even lower beds then appear, as the overthrust mass of the Normanskill (Chazy) shales and grits passes under the Rondout-Manlius cliff. That is the relationship past Catskill and Saugerties to Kingston.

The chronological dimension of the break, hereabouts, is thus conspicuous, large. Much must have happened during it: (1) deposition of the higher Ordovician beds, now gone, to a thickness we can only guess at but certainly over 2800 feet (all of Black River, Schenectady and Indian Ladder beds) plus perhaps fully as much again; (2) overthrusting upon these and folding of the Normanskill and older beds (exposed east of the Hudson), with great metamorphism farther east; (3) subsequent erosion of an unknown thickness of these overthrust strata, estimable in many thousands of feet since it reaches down to zones of severe metamorphism; (4) the slow return, meanwhile, of the Silurian epicontinental sea from the west.

We should therefore expect rather than discount (T. H. Clark 1921, Bost. Soc. Nat. Hist., Proc. 36 No. 3: 135-63) field evidence of this erosional contact, of such long time lapse.[2] Nor is this evidence hard to find (see figures 58, 13) when the contact is followed through continuously from Kingston across the Catskill quadrangle. Indeed, striking large-scale demonstration of the unconformity is given by the topographic map as a whole. Though in the south third of the sheet there is no appreciable lack of parallelism of the Ordovician strike-ridges, either east or west of the Hudson with those of the Silurian-Devonian rocks, the case is different from Malden and Katsbaan northward as the later rocks swerve more and more

Figure 58 Ordovician-Silurian contact, dry bed of Cats kill in Austin's glen, Catskill, at lower end of main gorge. Sandy Rondout layer (below boy) dipping left and away from camera, on Normanskill shale and sandstone diverging on dip to right at angle of nearly 10°. Boy stands on hackly waterlime. White ledge of Manlius in background. Looking northwest. Photo: drought of August 1912. H. L. Fairchild.

towards the northeast. Here the Ordovician ridges not merely fail to swerve with them but even run a bit more strictly north, thus increasing the convergence of their trend with that of the Kalk Berg range.

Ice movement has tended rather to obliterate than to accentuate this northward convergence of the Ordovician strike, amounting to an angle of about 15 degrees before approximate parallelism is resumed around Catskill and thence northward through the Coxsackie quadrangle.

Moreover, although throughout our area Doctor Ruedemann finds only one formation, the Normanskill, in contact with the Silurian, yet of that very thick formation different portions are at the contact. The seeming conformability (Davis 1883, page 322) at one easily visited spot, Cauterskill road exposure, north end of Quarry hill, is scarcely matched at any other. The actual contact is visible at the following localities:

1 Austin's glen. The exposure at low water in the Cats kill (figures 58, 1) shows divergence of nearly 10 degrees in the view, but because the face of the fall is not on the strike of the Normanskill the actual angular discordance is larger, about 15 degrees (Chadwick 1913). While sandstones underlie this contact, in the water, yet at less than two rods away, in the shore, a mass of soft shale is the underlying rock (figure 13).

A second contact is seen about a thousand feet northeast of the preceding. Around the point of the anticlinal hill (figure 1) and beyond clay and Normanskill knolls is a Manlius cliff facing the creek and surmounted by three cottages. The farm road at its foot has exposed the basal Rondout bed resting on Normanskill shales (with thin sandstones) and dipping to the east about 15 degrees more than these beds beneath, about under the middle cottage.

On the west of the creek, both in line with the first exposure and in the slopes of Eagle cliff (figure 16) as seen from the north in winter, the suggestion of discordance, with the Normanskill more closely folded than the limestones, is marked. Returning to the east side, up the old Austin millroad near its top the Rondout buff waterlime bed crosses at a moderate west dip and passes up into the hillside under cover. But just beyond, and striking directly under where it should be, the Normanskill shales and thin sands are vertical to slightly overturned. Below the road, however, they roll out into what looked to Davis (1883: 322 and figure 58) like parallelism with the limestones.[3] On the summit above, halfway over to route 23, lies a small quarry in which the relations seem conformable but rather obscure.

2 Cauterskill-Leeds road. A small brook cascading over the limestone where the Rondout is less than two feet thick, about three-quarters of a mile southwest of the preceding and not far west of the road, shows a strike contact in which it is not so easy to demonstrate unconformity.

3 Quarry hill and Fuyk. From the Cauterskill road exposure already mentioned, tracing of the beds around southwest into the Fuyk shows divergence of the heavy grits away from the contact and unlike layers beneath the Rondout at different points. There is a near-contact where Moon's farm road is first crossed. South of Moon's house, as the old road climbs up the Fuyk sandstone outcrop (where Gates's army once climbed it), Normanskill beds are seen beneath that with somewhat larger east dip and converging strike southward. Here the lower beds of the Fuyk sandstone are shaly and consist of reworked Normanskill arkose, but are unlike that in being coarser grained and carrying lime, enough to support colonies of the lime-loving walking fern.

4 Red (Brick) School. On the road sidling up the hill from route 9-W are plentiful Normanskill exposures, and the Fuyk sandstone cliff crosses at the top. Just short of this, on west side, the fossiliferous limestone is poorly shown, below the high main ledge, but with abundant fossils in the rotted stuff and soil, and just under it at road level are Normanskill sandstones (some shales also) much disturbed and cleaved but dipping 80 degrees east. Rotting of the rocks and overgrowth of vegetation obscures the relations until someone digs them out afresh. Especially puzzling is a seeming lateral replacement of the limestone in a rod or two south by heavy quartz sandstone, still showing fossils on fresh fracture. As there is a quirk in these beds immediately, offsetting them across the road, a small fault may be suspected, or even a slid block.

5 North American plant. On route 9-W one-quarter mile north of the road summit at entrance (west) to the North American quarries, or one-tenth mile south of the low point in the highway just after it turns from the West Shore railway, the Rondout beds on edge make a wall up on the west side to which one may clamber and find a contact with Normanskill beds that are more largely exposed northward. The face of the wall is the corroded under-surface of the sandy fossiliferous limestone, but there comes in just under this (20 feet above the road) two feet of heavy sandstone lithically so like the Normanskill arkoses (from which it has been reworked) as to deceive easily into the idea of conformability here. A second look, however, shows four to five feet of true Normanskill sandstone

(finer grained) and shale dipping west about 45 degrees into these vertical strata.[4]

On the continuation of the same outcrop south nearly two-tenths of a mile, in the West Shore Railroad cut, this deceptive basal bed is again exposed, showing about one and one-half feet, under the fossiliferous limestone, again all vertical and followed by nearly 12 feet of Fuyk sandstone, the rest covered. The base is also covered and no Normanskill shows, but like the similar stuff at the Fuyk it is easy to distinguish this basal Rondout sandstone from that by its lime content and coarser average grain.

6 West Camp. On the road crossing the limestone syncline, a half mile north of the historic West Camp church, in the south bank of the road on its west-side ascent, the Normanskill appears to be vertical, though this might be considered cleavage, as it passes under the rather good section of the Rondout limestones here exposed. In any case its strike differs, being about north-south, while the Rondout is striking west by north and dipping northward, not more than 30 degrees.

On the east-side descent of this road, toward Cementon, 14 rods above the hairpin turn, Rondout limestones on the north side dip about 40 degrees westward, on Normanskill shale and shaly sandstone dipping about 80 degrees eastward, thus meeting at an angle of about 60 degrees.

The west brow of this hill, on the thumb a thousand feet northwest of the former locality, has a good scarp of Rondout limestone looking far down upon the house at end of the stub road, and beneath this ledge (with its low northeast dip) is a ledge of Normanskill that dips east 40 degrees and continues south while the limestones wheel off to southeast.

The best instance of large scale difference in attitude in our region is the one just north of the cemetery and pond, easily reached by a short road from behind the church. Vertical Normanskill ribs strike north between cemetery and pond (and farther west), presently overlaid by gently east-dipping waterlimes at the extreme south tip of the limestone syncline. Standing on the knoll in the pear orchard northwest of the pond, one can look down a northeast-sloping surface of about two acres, eroded across these upedged Ordovician strata, against the Rondout scarp. This is a bit of the old land surface over which the Silurian sea transgressed in Rondout time, recently resurrected for us by glacial stripping away of the Silurian mantle.

7 Great Vly. Normanskill beds, mostly on edge, are displayed for half a mile at north end of the Great Vly while on both sides and

crossing over these are flat-lying Rondout limestones. Recent broad-gauging of their service track by the Lehigh company has freshened the contact at the west portal of their long tunnel (there are two tunnels). This contact had become obscured at the time of Professor Schuchert's visit. Here a measured 14 feet of Rondout (with about as much more above mostly covered) dipping east not over 15 degrees rests directly upon Normanskill shale flanked by a heavy mass of the grits, all dipping due east 80 degrees, making an angular discordance of fully 65 degrees.

Such relations obtain all the way up this east wall of the Vly for its two miles from the West Camp localities, though actual contact has not been seen except here and, again, at the "back" quarry entrance cut of the same railway as described and figured by Schuchert and Longwell (1932, pages 313, 314). They give the respective dips as east 5° south 30°-55° for the lower strata, and north 55° west 20° for those above the contact. Occurrence of thin harder seams at intervals of a few inches in the shaly Normanskill on west side of the cut (opposite the illustrations) has given the eroded edges a feebly washboard surface into which the Rondout base fits, with tendency for fossils to accumulate in the very shallow troughs (as at Rondout, N. Y.). There is no soil band, yet the large "worm" burrows that show on the under surface of the Rondout (see Schuchert's account) must have been largely excavated into softened shales beneath the contact. So far, no included fragments of the Ordovician have been found here in the Rondout. The nearly perfect planation of the Normanskill looks like wave-work, long-continued, and the smooth rounding of the harder ribs shows that the Normanskill was thoroughly indurated before the waves attacked it.

Although thrust-faulting is conspicuous in this same cut, all visitors agree that this faulting fails to involve the actual contact at any exposed point, just as it so failed in Austin's glen, showing how well the unrelated formations were bonded together along an interlocking contact. Yet they separate on weathering.

Over the knoll east of this cut, looking down upon the locomotive shed, the lower Rondout arches gently while upedged Normanskill runs end-on to within three rods of it. A short distance southeastward, or 200 feet east of the shed, the upturned Normanskill is thinly veneered by 15° east-dipping Rondout. On the west limb, southwest from the cut, there is a widening terrace of gently west-dipping Rondout, soon reaching back three or four hundred feet to the abandoned highway and finally terminating north of the old stone house near the head of the swamp. As it thus falls back west to the road-

way, on a 10°-20° west dip, 60° east-dipping Normanskill ribs emerge from beneath it, as also along its east front, and continue southwards. Practical contact may be seen close east of the road about 250 feet north of the stone house, and the two rocks are in close proximity for a quarter mile south to beyond where the road turns west across the ridge. In the exposure east of that gap, an excessive thickness of Rondout seems to be represented.

8 Shults's hill. Although now grassed over, the contact behind the garage at the Shults farmhouse three-fourths mile west of West Camp is still suggestively shown in the physiography, close by the public road. Here and north to the next farmhouse the limestone scarp is at its greatest divergence from the Normanskill ridges. The latter, with steep westerly dips, trend 10° west of north in a long succession bassetting up to the road on its east side, while the Rondout with northwesterly dip lies diagonally (N. 35° E.) across them, keeping mostly on the west side of the highway. Under this scarp, 250 feet north of the Shults garage and 70 feet west of the road, the shaly sandstone is exposed only 4 feet under the 13½ feet of Rondout here visible. At the garage, a five-foot grit bed dipping north 45° crosses the road, from the barn, and is exposed to within 25 feet of the Rondout, its ridge continuing to within 15 feet under the lawn end-on toward the limestone, which here dips northwest about 65 degrees.

9 Schoentag's. No actual contacts are known around Glasco, but the suggestions there present are included in this enumeration in order to embrace the south part of the quadrangle. In the vale of the ruptured anticline a quarter mile west of West Wood farm and an equal distance north of Schoentag's (both on route 9-W), the Normanskill is barely and doubtfully exposed close to the basal ("Wilbur"?) limestone of the Rondout on the west side of the pasture in the vale, but removal of sod and earth beneath this limestone might reveal it. The south prong of the hill south of Schoentag's, seven-eighths mile south of the road corners at the hotel, has a fine ledge of Glasco limestone climbing its east brow northward, with scattered Normanskill exposures below it (at and) near the south end. Here a grit ledge, dipping west 35 or 40 degrees and 10 feet lower than the Glasco, converges slowly northwards for about a hundred feet on the similarly west-dipping limestone until the lower waterlimes cut it off.

10 Becraft's mountain. The exposures of the unconformable contact here have been most lately described by Schuchert and Longwell (1932, p. 317-20) and by Doctor Ruedemann.

Supplementary Notes

[1] This thickness will be greatly increased if we take, instead, the clastic equivalents in the Mohawk valley of the Utica and Trenton, namely:

Frankfort beds (Deer River part)	350 feet
Holland Patent (with lower Frankfort)	800 feet
Loyal Creek	300 feet
Nowadaga	400 feet
Schenectady	2000 feet
Limestones	50 feet
Total Utica to Black River	3900 feet

[2] The latest review of the field facts is that of Schuchert and Longwell 1932, but containing some slight inaccuracies due to the hurried nature of their visit. See Davis 1883, 1883*a*, 1883*b*; Grabau 1903; Van Ingen and Clark 1903; Chadwick 1913. Davis 1883*a*, p. 318-21, summarizes the old accounts.

[3] Professor Davis's view was nevertheless modified on his 1910 excursion to this region, in which the writer participated.

[4] Given as horizontal in error by Schuchert and Longwell 1932, p. 313.

THE SUB-ORISKANY UNCONFORMITY

As the gap between the Ordovician and the Silurian formations closes up westward, across New York, there opens above it a different one, between the Silurian and Devonian deposits, that in western New York brings the Onondaga limestone down to rest directly upon a bed lower even than the Rondout (Chrysler), namely upon the Cobleskill (Akron) dolomyte. In this hiatus there are therefore missing the following formations present in our section:

Schoharie shaly limestone
Esopus shale
Glenerie limestone
Port Ewen and Alsen limestones
Becraft limestone
Catskill shaly limestone
Kalkberg limestone
Coeymans limestone
Manlius (Olney) limestone
Rondout limestones

Tracing it east from the Genesee river, this hiatus is found to be compounded of smaller breaks: (1) between the Onondaga and Oriskany, cutting out the Schoharie and Esopus; (2) between the Oriskany sandstone and the Bishop Brook (Coeymans?) limestone of the Helderbergian, cutting out the Port Ewen-Alsen, Becraft and Catskill members; (3) between the Coeymans and the Manlius. North of Manlius village, all three of these breaks may be seen in a vertical space of only eight feet.

Of these three, the upper one fades out in our area, the lower one will be considered beyond, but the middle one is of major importance. The noncontinuity and variable thickness of the Port Ewen limestone, together with its sudden swelling to more than one hundred feet, south of our quadrangle, have been mentioned in the

description of that formation. There is also a thickening of the Glenerie (Oriskany) beds southward, with incoming of the Connelly quartz-pebble conglomerate beneath them, around Kingston, besides pebble zones (not always basal) in the Glenerie cherts of our own area. Northward, in the Helderberg salient, the Oriskany sandstone, continuous with and equivalent to our Glenerie chert, rests on a corroded surface down in the Becraft, all Alsen and Port Ewen being cut out, though there is some return of these into the section at Schoharie.

Locally significant of this break at many exposures is the concentration of fossils and the occurrence of abundant dark nodules supposedly phosphatic on whatever happens to be the top surface of the eroded Port Ewen or Alsen. One of the best of such surfaces, followed by "black" shale that might be a soil bed, is well exposed on route 23-A (Rip Van Winkle trail) less than a mile outside Catskill, just north of and passing under the Glenerie beds (figure 31) at Ellsworth Jones's house. The same thing (with the shale bed) may be seen in the west wall of the northwest quarry at the North American plant close to where the pipeline is notched through it. It may be seen again on top of the east wall of the present Alpha quarry, especially at the high point near the south end. The nodules in the top of the limestone have been noted as far south as along the old stage road (upper road) a mile and a half south of Schoentag's. Nor are the nodules confined to the extreme top; they sometimes occur also a few inches lower, and the whole of this few-inch band is particularly yellowed and otherwise suggestive of subaerial weathering. It is quite possible that we are dealing with an old land surface.

Such a land surface is unquestionably buried by the Oriskany in western New York (see John M. Clarke 1907, N. Y. S. Mus. Bul. 107, pages 293-94), where the Oriskany sands infiltrate to depths of 20 feet or more the dissolved fissures and joint cracks of the subjacent Akron and Bertie limestones. Sometimes the Onondaga lime-sand does the same, as at Oaks Corners northwest of Geneva, N. Y.

At this break early workers drew the Devonian base and to it as the true tectonic division-line present thought is returning. It is the hemera of the volcanic outbursts (called "middle Devonic") in New England and beyond. It is the time of the earlier Acadian orogeny (mountain folding) in Gaspé and elsewhere. With increasing recognition of the essentially Silurian aspect of the Helderbergian faunas, as knowledge of the Rondout and Keyser faunas has grown, and after restudy of the European Hercynian, some of our best authorities

are putting the Helderbergian back into the Silurian where the earlier workers had it. For the opponents of this view there is still a good break below the Coeymans, now to be described.

THE COEYMANS-MANLIUS CONTACT

Recognition of an erosion interval between the Cayugan and Helderbergian has been tardy. The Manlius ("Tentaculite") limestone was early included in the old Helderberg (later Lower Helderberg) group, and as late as 1906 (see Grabau, Museum Bulletin 92) Ulrich and others were talking about "Manlius transition beds" in east-central New York and the Helderberg region. Inevitably, if such transitions or interbeddings actually occur as true depositional features, the separation of Manlius from Helderbergian breaks down. If, however, the appearance is due to extensive reworking of top Manlius into the Coeymans, as slabs and masses caught up or interfiltrated, the size of the break appreciably grows.

But that is exactly the situation that we have found and Mr Logie has confirmed. Wherever the Manlius-Coeymans contact can be reached on the Helderberg front it has proved to be irregular, undulating, but bonded and obscure until the hammer locates it by the lithology, and for at least two or three feet above it are many Manlius slabs, up to a yard or more in length, carrying of course the Manlius fossils and thus appearing to be interbedded with the Coeymans calcarenyte with its crinoidal and other organic debris. On a visit to this contact some years ago near New Salem, Mr Hartnagel and I found in it among the limestone pebbles a quartz pebble a half-inch in size. Before the later quarrying operations at the Turtle Pond quarry (figures 21, 22) west of Catskill, several geologists saw there a glacially polished edge of the basal Coeymans exhibiting the structure perfectly, near the north end. Even yet the worn Manlius slabs in the Coeymans can be found, especially at the south end of the quarry (figure 21) by close observation, and also in Austin's glen, giving rise to the oft-repeated statement that Manlius fossils are there found living on into the base of the "Lower Pentamerus" limestone.

According to Logie's studies, several feet of beds at top of the Manlius come and go on this erosion plane, around Catskill and Saugerties. But more significant is the cutting out eastward and complete absence in the Hudson valley of the upper three out of the four members of the Manlius found at Syracuse. We have here only the lowest division of the formation, namely the Olney limestone.

LESSER BREAKS

Blasting the Schoharie formation for the new route 23-A a short distance east of the Old King's road crossing three miles west of Catskill, the workmen brought to light a considerable concentration of glauconite grains in its top few inches. This has since been recognized at other localities in the same horizon. A little glauconite has been found also in the top of the Esopus shale at Katsbaan church, in the rear of the building. Since this mineral is considered an index of disconformity, we have in it evidence that the Oriskany-Onondaga gap (page 150) is not fully closed even in our region.

Repairs at the Webber bridge, on route 23-A, have covered up the evidence there beautifully displayed on a glacially polished surface of the Onondaga limestone of unconformity with the black Bakoven shale above it. Corrosion hollows in the top of the "white" limestone were filled with the black limesand (calcarenyte) that initiates the Bakoven shale, mottling the polished surface. This relation can still be made out by the creekside (figure 40) but not so well. Doctor Cooper's work seems to confirm this proof that no contemporaneous overlap can exist between the Ulsterian and Hamiltonian strata as was claimed. Small brownish phosphatic nodules and reworked *Atrypae* from the limestone beneath, in which they abound, occur at the contact, in the calcarenyte (a mere skin), as well as teeth of *Onychodus*.

The emergence and beginning of "continental" sedimentation of our region should be marked by some evidence of shallowing and withdrawal of the sea. Such seems to be afforded, not merely here but all across New York State, by the remarkable masses known as "storm-rollers" (figure 45) occurring at or near the top of the marine beds (here the Mount Marion formation) and even in the basal part of the nonmarine Ashokan beds above. Subspherical masses of sandstone usually a foot to a yard in diameter, surrounded sometimes by sand and sometimes by shale, are tumbled in, this way and that. They are certainly not "concretions" as they were formerly called. Their outside may be dusted all over with fossil shells (brachiopods) like cracker crumbs on a croquette, giving the impression that they were rolled along the beach when soft. Nevertheless, proof of such wave-rolling has not been found convincing to many geologists and a better explanation may have to be found. Rollers occur in the top Mount Marion beds just east of Unionville corners, as figured; two-tenths mile southwest of the bridge at High Falls, and almost continuously for half a mile along the road from High Falls over Timmerman's hill; on the road from Quarryville to Mt Airy and

south to near Unionville; on the road from Mt Marion to Daisy about a quarter mile above the bridge (figure 42) over the Platte kill. North of route 23-A they appear to be confined to the beds above the marine summit, which seems confirmatory of the idea of downward encroachment of the flagstone facies ("Ashokan") northward.

Pebble layers are to be expected in the land-made deposits and they begin with or even just before the Ashokan. Half a mile south from route 23-A, on the Timmerman's Hill road above mentioned, is a pebble-bed containing bright-colored quartzes rather than the usual local shale or sandstone pebbles. A cornstone stratum supposedly at the base of the Kiskatom red-beds in the vicinity of Kiskatom and northwards appears to be the "limestone, brecciated and conglomerate" recorded by Mather (1843, page 305, No. 129, pages 307, 314 and footnote) and called by him a firestone. A similar zone occurs in the midst of the flagstones at the break north of High falls mentioned on page 115.

The probable wedging out of the Genesee beds on the Catskill front has been discussed, page 136 and previous, page 122.

The undulatory contact of the Manlius on the Rondout, shown in figure 11, is probably of no consequence, being greatly exaggerated on the scale of the diagram.

Attention should be called to the question of northward disappearance of the highly fossiliferous upper Glenerie limestones, as though wedged out of the section. This is puzzling, since the very close affiliations of the whole Glenerie and Esopus seem to negate any such break between them, but its solution must be left to the future.

STRUCTURAL FEATURES

DEPOSITIONAL STRUCTURES

Any mention of "structure" in our region naturally brings first to mind the conspicuous rock folds and the faults for which this region is distinguished. Long antecedent to these deformations, however, were the structures put into the rocks as they were forming. Primary among these is stratification or bedding (figures 47, 72, and many other figures), usually very evident in our strata, but in the Esopus shale there is a surprising suppression of visible bedding (figures 32, 33) so that the subsequent cleavage planes are easily mistaken for bedding planes. Primary also is the distinction into different kinds of rock, either by chemical composition, as limestone (figures 21, 36), chert (figures 31, 23, 38), and sandstone (figures 8, 15), or by size of grain, as conglomerate (figure 51), coquinite (figure 27)

Figure 59 Channel fill, sandstone on shale, in Onteora beds of old quarry up north slope of Mt Tobias southeast of Willow. Lower part of the fill (in lower view) is of "storm roller" type, and all tends to weather in spheroidal fashion. Overlaid by flagstones. Looking west. Photos: September 1936, G. H. C.

Figure 60 Unsymmetrical syncline of the Quarry hill, west of Catskill seen from west foot of Lake Albany delta of the Cats kill in Jefferson Heights. "R": Rondout; "M": Manlius; "C": Coeymans; "K": Kalkberg; "NS": Catskill shaly; "B": Becraft, limestones. To avoid confusing, downfaulted block of RMCK at right is not labelled. Landslid clay in foreground. Looking south-southwest down the plunge of the syncline. Photo: April 1938, W. J. Schoonmaker.

and shale (figure 40) or clay (figure 72), as well as many so-called sandstones (figure 61) especially those alternating with shales (figures 42, 43, 44). Fossils (figure 20) are original structures, though often subsequently much changed, and so are the ripple marks, sun cracks (mud cracks) and "worm"-burrows.

Irregularities of stratification may take the form of cross-bedding (figure 18), flow-and-plunge or reefy structure, "storm-rollers" or "stone-rollers" (figure 45), channel scour-and-fill (figures 49, 59), disconformities (figure 21) and unconformities (figure 58), though the last involves deformation preceding it.

DEFORMATIONAL STRUCTURES

The transition from original to subsequent structures is bridged by such things as concretions (including the septaria found in the black Bakoven shale and the phosphatic nodules at certain contacts already named), which occur more commonly in the Mount Marion beds (figure 42), and flint seams (figure 38), both of which represent a concentration of foreign materials that may have started contemporaneously and progressed afterwards.

The simplest, probably the latest, of the strictly subsequent structures are the ubiquitous joints (figures 46, 15, 23, 51), at times giving rise to keystone faults (compare figures 71, 76).

This brings us to the deformative structures proper, or those produced by the mountain-making (orogenic) processes, namely:

1 Rock folds. The "miniature" rock folds of the Kalk Berg belt form one of the most entrancing features of our region. Because of their resemblance, in small, to the mountain folds of Pennsylvania and Virginia, Davis (1882) has rightly called the Kalk berg the "little mountains," for they alone of the hills of our area west of the Hudson have typical mountain structure, whereas our mountains (Catskills) are essentially a dissected plateau of upraised flat-lying strata. Davis has used the portion of the Kalk berg directly west of Catskill (Quarry hill and Fuyk, figure 60) also in illustration of his six physiographic types in regions of folded rocks.

It is strange that this beautiful and diagrammatic folding should have had so little notice from earlier writers (see Davis 1883), but Mather wrote (1843) before the appearance of the works of the brothers Rogers describing the huge folds in Pennsylvania and the Virginias. He has many illustrations of tilted rocks and several references to "lines of dislocation and uplift," by which he seems to mean faulting. Sometimes, as at Glenerie falls, his interpretations of structure are incorrect. To Davis and to Darton we owe the first real knowledge of our structural features.

The up-archings of the beds are called anticlines (figure 61), the down-sags are the synclines (figures 28, 68), while a dip in one direction only constitutes a monocline (homocline), as in the Hooge berg (figures 41, 3), but most monoclines (uniclines) are one limb of a syncline (figures 21, 30). A constant feature of our folds is that they are unsymmetrical, leaning to the west in the direction of the push so that the west dips are steeper than the east dips (figures 60, 13, 28, 68), and exceptions to this are very uncommon. One such exception, with the east dip the steeper, occurs in the Schoharie beds on the east side of route 32 at the four corners a mile and a half northwest of Saugerties.

This over-pushing may amount to an actual overturning of the strata, as in the West ridge of the Fuyk and in much of the Normanskill, which, having been through two periods of mountain-folding and being mostly unresistant ("incompetent") shales, has been sharply (isoclinally) plicated back and forth upon itself (figure 63) with some of its folds even laid upon their backs, and nearly all of them greatly pinched. But plication occurs also in the Catskill shaly limestone (figure 69) which has been through but one mountain-making.

One of the prettiest little folds in the country is that produced in the Rondout waterlimes at the entrance to Austin's glen (figure 13) by the gliding over it of heavier beds of the Manlius—a complete S with the middle limb (or reverse curve) rotated beyond 180 degrees. In miniature we have similar crumpling in clays where they have slumped.

2 Faults. In beds so greatly compressed as ours it would be surprising if they did not fracture and slip. Such displacements are called faults and in our region they are invariably thrust-faults, in which relief was obtained by telescoping. An overturned anticline easily slides on over its neighbor syncline (figures 26, 69), or it may rupture at the crest and shove before folding has gone far. A syncline in heavy beds when pinched too far may have its core wedged upward at both sides (figure 65). Steeply upturned strata may be simply torn across and one block pushed farther west than the other, resulting now in slight offset of the whole ridge such as occurs in the limestones north of the Ulster town line. Normally our thrusts are overthrusts, the upper block (slice) being driven westward. But occasionally there are underthrusts, in which the lower block moved west. Thrusts have also developed in slid clays.

On the fault planes, the grinding of the surfaces upon each other produced slickensides (figure 19), which sometimes follow bedding

Figure 61 Part of a graceful anticlinal arch in Normanskill sandstones and shale on the Cats kill (old railway grade) at south portal of Austin's glen, Jefferson Heights. Looking north-northeast. Columbia University photo: about 1917, courtesy of H. L. Alling.

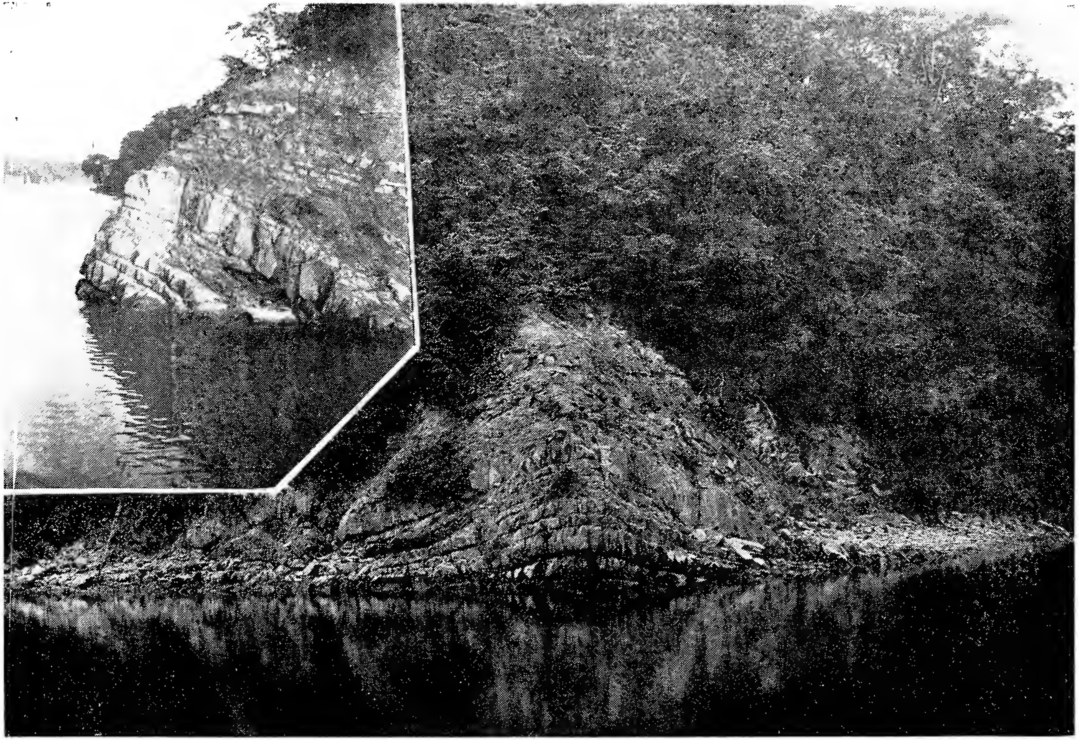

Figure 62 False anticlinal effect in Normanskill beds at the Hoponose on the Cats kill, in south part of Catskill village. Looking nearly south. Columbia University photo: about 1917, courtesy of H. L. Alling. Inset, looking east-southeast, shows the real dip, which was away from the camera. Photo: about 1920, Charlotte Pettengill.

Figure 63 Isoclinally compressed synclines of Normanskill shale in old Catskill Mountain Railway cut (now filled up) between Main street and River street at the "Point," Catskill village. Part of a succession of such tight folds. Looking south-southwest. Photo: April 1915, G. H. C.

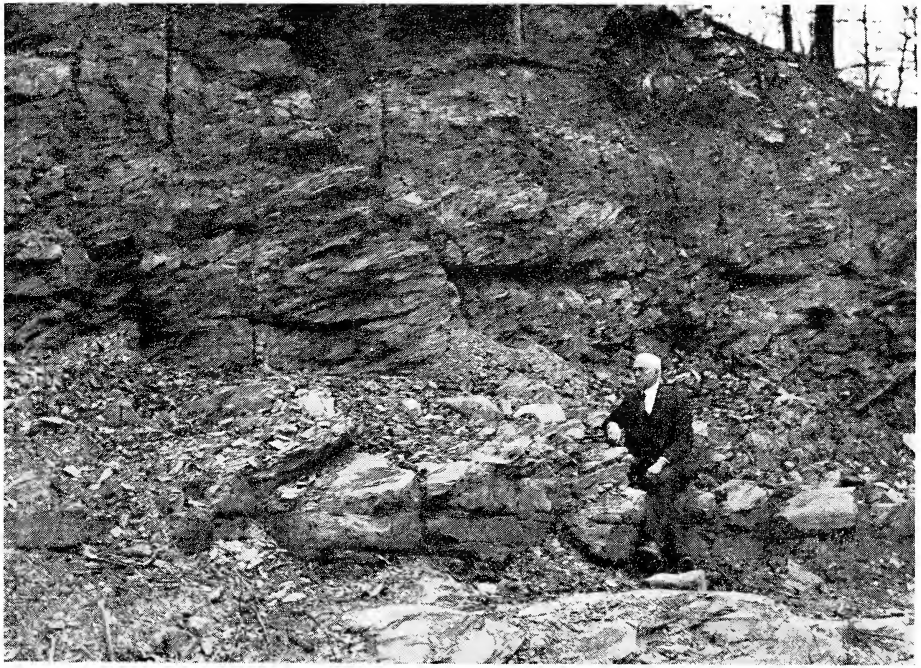

Figure 64 Diagonal cleavage of horizontal beds of Schoharie shaly limestone on Cauterskill-Leeds road about one mile north of Cauterskill. North end of a syncline, showing push (with overturn farther east) toward west. Chadwick sits on harder limy beds less affected. Looking southwest. Photo: April 1938, W. J. Schoonmaker.

planes. Adjacent edges were often curled under (dragged) as they slid (figures 26, 67), and at the same time, or independently, so strained as to become strongly cleaved with the cleavage angle pushed over in the direction of thrust (figures 64, 34, 41) whether in fault or fold. Cleavage in the homogeneous Esopus shale is, however, more inclined to be vertical to the bedding (figures 32, 33) and reminiscent of that in the unconsolidated deposits known as loess.

Fault planes may contain up to several inches of ground-up rock that yields quickly to the weather and is known as gouge, as well as indragged fragments oriented with the fault plane. Or some feet of beds may be rolled up and crumpled between the moving surfaces, as well shown in the far wall of the south quarry at the North American plant (figure 68 and compare figure 66). The larger masses thus dragged in are known as horses and may consist of rock different from that which incloses them, thus show on the map, as the bit of Fuyk sandstone two rods long by one rod wide beside the woodroad through the pines three-eighths mile south-southwest of the Red Schoolhouse and directly back up over the brow from the "big spring" (page 12) on route 9-W; or the eerie and much larger knoll of misplaced Becraft and New Scotland beds on the west fork of the woodroads along the Kalk berg, at summit of the Esopus vale seven-eighths mile southwest by south from the junction of route 23-A with route 9-W, near Catskill.

In place of a simple slip, a mass or zone of broken rock may occur at the fault. Such a fault breccia is well displayed in Rondout limestone where route 9-W bends around it 300 feet south of the North American conveyor-underpass. In the multiple slicing of the Fuyk sandstone on the south end of the West Fuyk ridge, brecciation characterizes the third and fourth of the five slices and excellent specimens may be obtained.

Calcite veins are common in both fault planes (figure 69) and fault breccias, as well as in strain cracks. In fact, the presence of calcite veins in our rocks is a trustworthy index of faulting. The calcite often takes a mold of the slickensides, as on Quarry hill, and it was probably this that received the name "fibrous calcite." Nice specimens of the white cleavable calcite may be gathered near the upper end of the old Austin millroad, derived from joint cracks and especially from a thrust plane up in the cliff (Davis 1883, figure 3).

While thrust faults accompany folded rocks, quite a different type of faulting is usual in flat-lying strata, and having been the first kind studied is called "normal." In a normal fault the upper block moves down, relatively, instead of up. No true normal faults have come

to notice in our folded rocks and but one in the monoclinal zone to west, namely at the south (left) end of the cliff shown in figure 42 where a slip of at most a few feet cuts off the coral bed in the water, as discovered by Doctor Cooper, and is traceable up to a notch in the hilltop as a down-dropped wedge or small "graben." A small normal fault in our mountains will be described with the keystone faults, of which the preceding may also be an instance.

ARRANGEMENT OF STRUCTURES

The rock folds of our region all lie east of the Bakoven valley and do not involve the thick Hamilton and Catskill Mountain beds. Those of the Ordovician strata, which went through a second compression after erosion had bevelled the tops of their earlier plications and which have since been much covered by Lake Albany clays and other Pleistocene deposits, on both sides of the Hudson, are today scarcely decipherable. It is in the thin formations of the narrow belt of the Kalk berg that one's wits may be employed, yet even where exposures are plentiful and the surface facts not obscured that which is found is often almost incredible, difficult to imagine in underground extension, impossible of satisfactory reconstruction as to the mode and processes of origin. The map itself, especially in the cement region, looks like a disordered nightmare and that is just what the region has proved to be to the cement companies, whose quarries have revealed to us marvellous complications (figure 69, for example).

A peculiarity of our folds, in which they seem to differ from the great mountain folds of Pennsylvania, is their discontinuity. Except the large syncline extending from Quarry hill to West Camp, which so conspicuously offsets the whole series eastward, few folds can be traced any distance before they rather abruptly die out and give place to new ones arising beside them. Odd zigzags and diagonal cross folds are thus repeatedly found to occur. This is specially characteristic of the Onondaga and Schoharie in the Saugerties district, where the edges of these formations regularly fray out northeastward every mile or two. The ends of folds where they terminate against the cross synclines frequently plunge underground with surprising speed; as the north end of the great arch of Alsen limestone at Klee's hill, southwest of Van Luven's lake, which terminates northward the anticline of the Great Vly, and the companion or overlapping arch of the Schoharie-Onondaga beds on the west of it. Similarly, route 23-A goes down a diagonal vale between overlapping ends of Schoharie anticlines, from the Old King's road to the Webber bridge over the Kaaters kill.

Figure 65 Wedge faulting in the south quarry at Alsen. A wedge of massive Becraft limestone is driven up to right (west), by the squeezing of the syncline, on the plane marked by the arrow, and a similar wedging is less clearly visible on the opposite limb. Note overturn of Alsen limestone at skyline on left of axis, as marked on figure 28, and cave opening in Becraft half way up on far right. Looking south. Photo: May 1938, W. Storrs Cole.

Figure 69 The noted overthrust in the north wall of the north Alsen quarry of present Lehigh company's cement plant at Alsen, N. Y. Observe fault plane rising to west and bent upwards where a wedge of Alsen limestone is driven under it; above, the vertical to overturned beds in the upper slice, consisting of Becraft limestone at left (no Alsen there) and the somewhat plicated Catskill shaly limestone at middle and right; beneath the fault, the undisturbed Becraft limestone (light colored) at bottom, overlaid by successive wedges of Alsen limestone, becoming drag-cleaved in the upper part, whose exact limits (fault planes) are not easy to trace, even in the field. Looking about north-northeast. Photo by Robert W. Jones.

Figure 68 Operations (1938) in south quarry of the North American Portland Cement Corporation, west of DeWitt's point, five miles below Catskill, on route 9-W. Transportation is by dump-cars and steam locomotives to crusher plant. Quarry being cleared for blasting of far (south) face. An unsymmetrical syncline of Becraft, Alsen and Glenerie beds, very sharply upturned and squeezed thin on east limb, as seen at extreme left, near which the Alsen makes about lower third of height of the wall, and the Glenerie cherts the upper two-thirds, with separation at a line of dark shale. Line between Alsen (darker) and massive Becraft (lighter) well seen in middle of view (below the drilling rig), to right of which this Becraft is duplicated by a wedge-fault zone (of much crumpled layers) rising and narrowing diagonally up to right. West wall is rejected lower less pure and thinner layers of Becraft, with strong east dip. Looking about south. Photo: November 1938, by courtesy of their general chemist, H. E. Kichline. (Camera slightly tilted.)

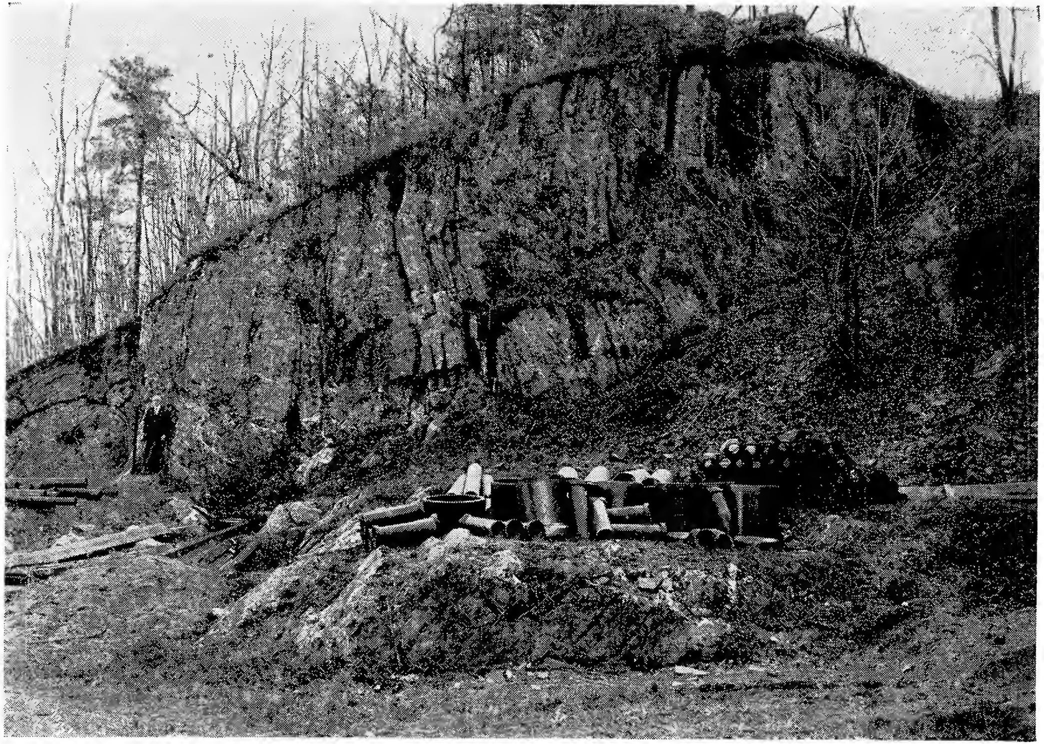

Figure 67 Underdrag on overthrust at Canoe Hill town stone-crusher quarry, just north of Saugerties. West limb of an anticline (note arch in Manlius on left) driven west (right) on a plane located almost at nearest floor of quarry, with marked "drag" overturn of (Kalkberg limestone) beds below the tiles. Coeymans (man standing against basal layer) about 21 feet thick. Kalkberg (et cetera) about 39 feet. Looking south. Photo: April 1938, W. J. Schoonmaker.

Figure 66 Detail showing "takeup" of the fault by contortion of the lower thin-bedded Becraft in bottom of the syncline; position in figure 65 identified by dark solution cavities at top of view. Mr Kilfoyle's hand marks the fault plane. Photo: April 1938, W. J. Schoonmaker.

The general westward overturn of the axes of the folds, which carries the beds always deeper westward in each such undulation until those at the Hudson go far beneath sea level under the Catskills, and the simpler cases of faulting have already been described. Some special cases are soon to be taken up. It is well first to note how frequently we have to deal with eastward as well as westward thrusts. Not all of these are to be classed as underthrusts. In the folding of a syncline, the layers naturally tend to glide upon each other upwards on both sides of the axis, eastward (figure 19) as well as westward. The heavy Mount Marion sandstones have thus overridden eastward the Bakoven black shales at Houck's "coal mine" (page 103).

The same relief may be accomplished instead by faults rising diagonally (figure 65) up both limbs and lifting a wedge-shaped mass within the core of the fold. The snap on the east limb is then as much of an overthrust as that on the west limb. Such snapping or wedge-telescoping eastward (as in lower part of figure 19) accounts for much of the repetition of the Manlius and its inclosing beds along the east front of the Kalk berg from West Camp northward through the cement region to the Red Schoolhouse. It accounts also for the long parallel strips of Becraft, Alsen and Glenerie on the opposite side of this syncline through a part of the same stretch. It explains many other "strike faults" and many little diagonal cross slips on upturned beds, as in the Schoharie east of Asbury.

Deceptive resemblance to young normal faults may result from fresh cliffing of the overriding mass along major joints, as frequently in the Becraft strips on the far side of the West Camp syncline, but the truly overthrust relations are revealed in the quarries and by the behavior when followed on the surface "trace." It is unfortunate that the already crowded formational lines upon the map have made it inexpedient, where not actually impossible, to draw fault lines as such on it. Therefore the presence of the faults is revealed only where they offset the formations and is concealed at intermediate points.

SPECIAL CASES

Some of the features that do nevertheless show on the map deserve particular description. These fall into several classes, but it is noteworthy that all of them appear quite uninfluenced by the jointing now present in their rocks and seem to prove that jointing is a later and probably more superficial (shallow-seated) process than folding and thrust faulting.

1 Pivotal faults. All our fault lines tend to die away and disappear unexpectedly. This is most noticeable on the map, and most easily

explained, in the case of fault blocks anchored at one end, from which they have pivoted westward, rotating upon the under block. Such faults are illustrated at the Indian Caves locality a mile and a half southwest of the bridge at Saugerties and again in the same Schoharie beds at Mower's crossroad nearly three miles north, in both cases the north end being swung, as it is also in the east or upper block on the hill south of Schoentag's in the New Scotland and lower formations and in the special case of the Canoe hill, Saugerties, to be described in another connection. Doubtless if we had the whole story, now lost by erosion, we would find the strata returning eventually to another pivot. Such pivoting of the other end indeed occurs farther north, in the rotated blocks on the hill above Cementon which puzzled the operators. A case in which the upper block appears mysteriously to have been rotated east instead of west is that of Mr Fera's hill a half mile east of Katsbaan church. The pivoting at the Fuyk (figure 15) is plainly part of a ruptured anticline.

2 Derelict hilltops. We may coin this expression for the disconnected block on the Kalk berg two and two-thirds miles southwest of the bridge at Catskill, and for others like it which have trespassed far across other structures. The noted overthrust hilltop (figure 69) above the Alsen railway station has been taken for such a mass, but it is actually pivoted to the south end of the south quarry as the map shows, being similar to the hill summit north of the bucket line at Cementon but oppositely oriented. In both cases the strata are vertical; in both there are jammed against the east face masses of the lower limestones in inexplicable fashion.

3 Multiple slices. The imbricated arrangement of the successive pivoted blocks above Cementon is easier to recognize on the map than is the vertical imbrication of four successive sheets of Manlius in the hill south of the Red Schoolhouse and above the "big spring" on route 9-W. Visual separation of these may be made by following the discontinuous bands of the underlying Fuyk sandstone or of the overlying Coeymans-Kalkberg limestones that are drawn in between them, often giving place one to the other abruptly along the strike. Though the upper slice is interrupted at the crossroad, it resumes beyond, and the disconnected or derelict hilltop already mentioned seems to be but another (fifth) slice, as will come out in the section on nested folds. Multiple slices, five in number, occur also in the West ridge of the Fuyk, where figure 15 represents the topmost or fifth slice. Incipient imbrication of four slices is found on the south side of Austin's glen (see figure 26 for one of the faults).

4 "Downward" overthrusts. Discovery at Canoe hill, Saugerties,

of a thrust fault (Chadwick 1910) in which the upper block appears to be slid downhill was the first intimation that our "miniature" overthrust planes are undulated (folded) as are the great ones in the southern Appalachians. The course of the field mapping found this to be by no means an unique example. The Canoe Hill fault may be looked upon as essentially pivotal, though possibly a little broken on the pivot and also complicated by a sharply pinched anticline on the east that brings up the Glasco limestone. It is so easily visited, with a village street continuing through the hill on its trace, that it is worth brief redescription.

On the south or overthrust block the Glasco limestone makes a sharp rib just behind the modern house on the corporation line. West on this line all the succeeding limestones up to the Glenerie at west base of the hill are found in regular order and highly upturned (figure 67). Northward are quarries, a larger one in the Coeymans-Kalkberg (figure 67) formerly worked for the town stone-crusher, and smaller diggings in the Catskill shaly and the Becraft, near where all of these terminate against the road. Just east across the road from the crusher quarry, in the yard behind the house at the intersection of the sanitarium spur-road, are ledges of the Becraft limestone, soon backed on west by the Glenerie at the roadside but best displayed beyond, opposite the next houses and past the tip of the south block, where it makes bare surfaces running steeply far up the west slope of the north half of the hill, while Becraft still shows in the houseyards far below it.

On the west side of the road at the first telephone pole up from the crusher quarry may be seen the slickensided, calcite-filled fault plane itself or a split of it, sloping down west between Kalkberg limestone above (Coeymans at left) and about three feet of what looks like Glenerie limestone below, with a rotted zone under the fault. There is marked drag on the bottom of the upper block, shown on a larger scale in the quarry (figure 67), in which the fault plane still drops rapidly west beneath the quarry floor. A calcite-cemented fault breccia of the Manlius makes a ledge south of the quarry entrance.

The important thing in this description includes the strong westward "hade" of the fault plane where seen and the still steeper attitude that it must take to north to let the Becraft down below the big bare surfaces of the Glenerie. The difference between such a fault and a normal fault is that the latter continues down into the earth whereas the thrust plane curves back up again. It is now possible at many points in our area to see thrust planes folded into anticlines and

synclines, as will come out in the next section. The possibility of this being a "snap" in which movement was up east instead of down west is opposed by the thickness and number of formations involved and negatived by the relations farther north. A similar pivotal fault, with similar westward tilt of the fault plane, occurs in the north half of Canoe hill, wholly unconnected with this one, and is definitely not a "snap."

5 Nested folds. Four examples have been found, in the Kalk Berg range of the Catskill quadrangle, of a structure in which the strata are repeated upward within the same anticline. The impression given in every instance is that of flat overlapping fault slices having been subsequently arched, simultaneously, into an anticline. As there has been no north-south telescoping in our region, no other mode of origin suggests itself. All of them are fully open to observation. (See figure 70.)

a The simplest one is on the high hill east of the Cats kill (right hand of figure 1) at the point in Austin's glen where that stream crosses the Manlius and Rondout formations. The beds are upturned steeply, at right angles to the creek where it leaves them (just above which it has been approximately on their strike; see figures 23, 25), and they rise up the east bank at a high angle of west dip, then arch over prettily in an outlook cliff.

Along the creek and the old railway grade that follows it all seems to be regular in the section of the Manlius, Coeymans, Kalkberg and Catskill shaly limestones. But on the hill crest (the anticlinal axis) the case is different. Starting from the outlook cliff of Manlius at the south end, which is plunging noticeably northward, one comes in six rods north to a ledge of Coeymans topped by three to four feet of cherty Kalkberg showing a strong cleavage dragged over to west. The next exposure above this, seven rods farther north, is Manlius again, the Stromatopora bed, capped by Coeymans making a good ledge at three or four rods beyond. Finally, in another five rods, comes a high ledge of the full thickness of Kalkberg limestone, whose top is the level crestline of the hill.

As these ledges roll down the west side to their steep west dip into the creek, a fine vertical cliff of the Catskill shaly comes up on the flank, reaching the level of the broad hilltop within 200 feet north. Down this slope, also, the upper Manlius cliff bevels out, from base upward, against the Kalkberg below the fault plane, letting the upper Kalkberg sheet down upon that. But on the east slope, where the anticline is followed by a quick upturn on a subordinate syncline, it is the lower Kalkberg and Coeymans that can not be traced far

north before the two Manlius sheets seem to close in and cut them off, though the exposures here are not so good. This is exactly the relations that would obtain if a low-angle thrust had cut up across horizontal strata and then all had been folded into anticline and syncline. The mechanics of telescoping the beds in this fashion, on a recurving plane, after they were folded are unbelievable. That it is not a "snap" is proved by the direction of drag-cleavage on the lower sheet of Kalkberg.

At creek level, this fault plane is probably concealed up in the weak shaly limestone, in which there are several little ruptures visible to right of figure 23, and may re-emerge beyond in one of the three or four thrusts of the Becraft already mentioned, on far side of that syncline. Moreover, it likely is the same as the plane found across the eroded anticline to east in the "Glen Cliff" Manlius ledge on which are the three cottages (page 145), responsible for the sharp prong in the Manlius outcrop at its north end, and therefore that of the Austin millroad (Davis 1883, figure 3). That would take it over three synclines and two anticlines. Whether it is the one that offsets the Schoharie beds still farther west, near north edge of the quadrangle, remains to be learned.

b A second instance is on the Kalk Berg ridge overlooking the Pine View filling station on route 9-W about two and a half miles south of Catskill. Access is good by two old woodroads that sidle southwest up the ridge, from respectively 400 feet north and 100 feet south of the station.

Up the north road, vertical Fuyk and Manlius are crossed in small exposures and flat-lying Manlius (a different slice) found in the hairpin loop at the top resting on folded Coeymans and Kalkberg that strike north under it but break off south in a good cliff looking down upon the other woodroad. This cliff rises thence west, arches over the hill and down on the far side, in the edge of the evergreens, picturesquely. In it was observed a favosite coral almost two feet in diameter. But this arch plunges slowly north into a hollow in which runs a connecting woodroad, and a second similar arch of Kalkberg limestone (underlaid partway by Manlius and Coeymans) wraps over it, also plunging north and going under the Catskill shaly where the north woodroad winds around on the line of contact between these. The intervening wedge of Manlius comes up from the flat exposure on the east brow and cuts out down the dip as did the one in Austin's glen, while the Coeymans continues on around with the Kalkberg of the upper sheet far south on the west of the north-south connecting road.

Eventually, at south, this fault plane connects with one of the higher ones in the multiple slices south of the Red Schoolhouse. Northward, the strata of the upper slice soon turn up on edge, the lower Kalkberg and Coeymans being immediately lost and the two sheets of Manlius merging finally somewhere under the talus. The conditions thus parallel closely those at Austin's glen and a similar fishhook of Manlius appears on the map in both places.

c A third example, but much more complex and requiring wider exploration to encompass, lies not far southwest of the preceding, easily reached by the south path from the filling station. It includes the derelict hilltop already discussed, as its uppermost slice. There are here four anticlinal sheets of Becraft nested one above another, with intervening beds of Catskill shaly and Alsen.

The exposure of the lowest Becraft sheet is small, the mere eye of a fenster (page 185), but easily found in the open ground just east (four rods) of the Streeke sink—point of disappearance of all the drainage from the surrounding wilderness as well as that from Van Luven's lake. Here is a west-leaning anticline of the limestone, but the actual exposure is only a hundred feet long and three or four yards wide, merely the vertical west limb and the arching crest. The east slope, of gentle dip, is grassed over, though other deep but dry sinkholes down to east a few rods betray the presence of the limestone still beneath them. On south, the Alsen overlaps short of the powerline tower (No. 418), and may sheet over all the back slope.

Following the powerline north, one finds a second fine ledge of Becraft arching over this Alsen, though bevelled out on west, and running far southeast behind the sinkholes mentioned. It bears Alsen again, the full thickness, on its back, then the Glenerie cherts northward from the next tower (No. 419) well into the woods, nicely arched and declining northwards. Diagonally across these comes the Catskill shaly of the next slice, followed regularly up the slope in the woods by the third Becraft sheet wrapping over it and curving down likewise to the deep Esopus vale on west, into which all the beds have dived. Once more the Alsen succeeds, in good ledges, and has a long and broad north-plunging crest against the fourth and highest crest of the Becraft, equally anticlinal with all that precedes it and making the high summit north of the evergreen woods.

We must leave others to struggle with the problems of magnitude and of the eventual takeup of such extensive movements. The present visible width of the Becraft-Alsen slices, flattened out, inclusive of their known synclinal extension eastward in the two upper slices, is not less than 400 feet for the top slice, 900 for the next and 500 for

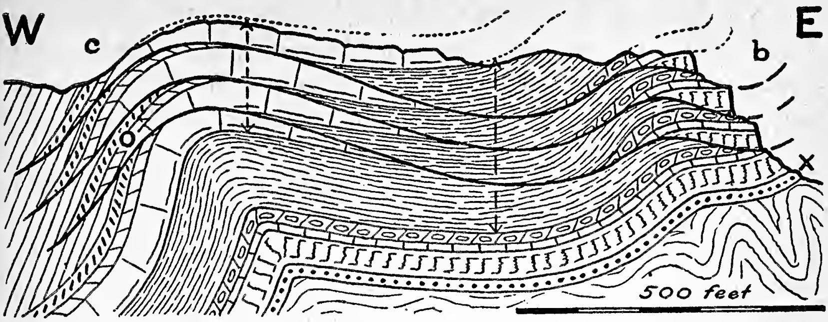

Figure 70 Schematic diagram of "con-plicate" fault-slices (nested folds), as in Kalk Berg range near "b" and "c" of the text, which are one structure. No vertical exaggeration except that folds plunge away from the eye. Water entering at O somehow emerges at X without apparent limestone connection. Note overthickening of beds as marked by arrow-tipped lines.

the third one down, which, considering the bottom slice as stationary, means at least 1800 feet of telescoping of the Becraft-Alsen. If the beds were practically horizontal when the thrusting occurred, these thrust planes should have run westward up into parts of the Esopus (and greatly overthickened it) that are now turned down under the Schoharie just to the west—merely across the Streeke lakebed, as the map shows. But if so, then this upturned overthickened Esopus must subsequently have been largely overridden by the whole mass of limestones driven over it from the east, for the present belt of Esopus outcrop is here now decidedly narrow.

The point to be emphasized again is that of the two thrust planes that can be followed (the lowest one being lost to view underground from the fenster), both recurve synclinally on the east, and strongly broadly so, along with the inclosing strata. That they could have developed at all with the beds folded or even slightly deformed from straightness is unthinkable. Each of the upper slices has Manlius finally on its eastern edge and the lower of these two is identical with the higher sheet in the locality to northeast previously described, thus extending the middle fault-plane over a second anticline and syncline. Directly west of all this disturbance (and more faulting yet on south), runs the remarkable straight (only slightly arcuate) syncline of the Schoharie, to which the perfectly straight powerline is tangent at both horns.

d Somewhat different, simpler but a bit harder to see in the field, is the anticline over anticline in the Onondaga, Schoharie and Esopus beds northeast of the Green schoolhouse on the Old King's road. Access is best by an old wagontrail just south of a new house

three-eighths mile north of the school, where the highway bends away from the hillslope and out upon the clayplain. Not far up the slope is found Onondaga limestone with calcite veins (always indicative of faulting). The limestone makes a good arch, southeast up over the hill, in the woods, while on north its outcrop is an increasing ledge. Straight east one climbs up on west-dipping Schoharie to a ridge that breaks down to east, across an anticlinal axis of Esopus, beyond which the Esopus forms a syncline holding another strip of the Schoharie. All is regular, to the eye, in this cross section, except for a sinkhole in the Esopus at foot of the first drop. Neither the Esopus nor the Glenerie below it makes sinkholes.

But just south across the fence, in the woods, is the arch of Onondaga limestone that has been mentioned and that is now seen to pass north directly under this Esopus arch with its sink. The anomaly of a sink in the Esopus is explained.

The Onondaga dips east underneath the Schoharie syncline of the upper slice (with a cave that receives the waters of a small brook), and these relations continue onward to south for a third of a mile until all goes under the meadows. Within a quarter mile in the opposite direction (north), the Schoharie ridge of the west strip is found to offset abruptly, its wide outcrop of moderate dip superposed upon a narrow belt of vertical Schoharie beds that run on north out from under it, and south from here back to the start the Onondaga limestones are found to be diagonally overridden and cut out by the upper slice Schoharie until only a small thickness remains where first seen.

Though there is not so close correspondence of the axes in these superimposed anticlines as in the cases previously given, yet the amount of movement that would be required here to slide one large anticline over upon another, along a curved plane, involves greater mechanical difficulties than to slide the beds first, a much less distance, and do most of the folding of them afterwards.

6 The incompetent Esopus. Attention should be directed to the variety of formations in contact with the Esopus shale along its eastern boundary, in the north half of the quadrangle. These range from the expected Glenerie down to the Catskill shaly limestone, the different beds coming and going at the contact with surprising facility. The explanation is, of course, that the Esopus shale was sufficiently yielding as to serve for the buffer zone or "takeup" rock of the overthrusts of more rigid and more brittle beds beneath it.

There is a continuous overthrust upon it for nearly its entire front of three miles in the Quarry hill-West Camp syncline, and again

from the Great Vly south for nearly two and a half miles to near Katsbaan Church, with lesser strips both north and south of that one. Why the same thing is unknown in the south half of the quadrangle is not clear, except that the point of cessation coincides both with the bend in the Kalk berg and Hooge berg at Katsbaan discussed on page 12 and with the north termination of the highly fossiliferous upper Glenerie limestone.

There is one clear case of thrust from the west upon the Esopus, that of the Onondaga upon it something over a half mile north from Van Luven's lake, nearly meeting a thrust of limestones from the east.

THE BELT OF FOLDING

The folds and faults of our Silurian and Devonian rocks have been mentioned as peculiar to the thin formations of the Kalk berg. As we step west of the Hooge berg we leave behind us practically all traces of disturbance. Our mountain rocks lie almost as flat and placid as when they were born. Northward the zone of folding runs but a short way into Albany county; southward it stops short almost at Kingston and gives place to the great Appalachian swells of the Shawangunks.

The older idea that our "little mountains" are the tail end of the Pennsylvania mountain folds, greatly diminished in size, seems no longer tenable. There are similarities of structure, to be sure; our Kalk berg imitates in miniature many of the most characteristic elements of Appalachian structure. But there is no gradation. The tiny folds stop short and the big ones begin. An angle between the two complexes, near Rondout, serves further to differentiate them. The Pennsylvania folds mostly run out into southern New York and fade away in the far western outskirts of the Catskills. They do not join up with our little undulations.

Rather significant to us is the fact that the folds in the Helderberg scarp, as traced north from Catskill, end suddenly just where a major overthrust in the underlying Ordovician beds emerges from beneath the Manlius cliff. The general course of this thrust trace, projected southward, would pass about along the general line of the Esopus shale on our map. Significant also is the fact that the Becraft's Mountain outlier of these same limestones does not show the same intense plication except in its southeast rim (Grabau 1903) but does possess, according to Doctor Grabau, a system of normal (as well as of overthrust) faults not found on the west side of the Hudson.

The narrowness yet intensity of this folded belt, its localization east of the Catskills and still more its coincidence with the Ordovician thrust zone where that can be observed, namely at both ends, all strengthen the belief that these strata have been crumpled upward upon the toe of the underlying Ordovician overthrust fault slice in a recrudescence of its westward progress occasioned by the urge of the second mountain shove. It is wholly possible, as discussed beyond, that this second shove was independent in time as well as in localization from that of the Pennsylvania folding to which authors assigned it and which infringes upon it in the Rondout-Binnewater region.

KEYSTONE FAULTS

Recognition of the letting down of vertical wedges of rock (see page 17) in zones of close-spaced master joints, as a process still in progress, explains some physiographic features of our mountains, as already noted. In the fissured zone any blocks that happen to narrow downward will settle by gravitation whenever the zone is opened the least trifle, as by temperature changes or momentarily but repeatedly during the passage of earthquake waves, just as the latter drop the keystones in arches of buildings or bridges. The ensuing compression may wreck these blocks, as in the jaws of a stone-crusher. Deep fresh trenches in solid rock result. Displacement of the opposite jaws is not implied, seldom happens.

Paralleling the mountain valleys are some long straight slots in the anticlinal limestone ledges of the Kalk berg suggestive of keystone faulting. Mr Tipp's house road, on east of the old stage road (upper road) one and an eighth miles south of Schoentag's, runs in such a slot in Becraft limestone behind but not quite parallel with the faultline cliff of an overthrust. The association is accidental, though the two are combined northward behind Mr Brink's barn as a deep dry chasm.

A half mile west of Van Luven's lake the little used road on the west side of Klee's anticlinal hill follows up another such gash in the Becraft and Alsen, the line of which is prolonged southward, perhaps even to the entrance of the "back" Lehigh quarry. East of it 750 feet is a notch in the Becraft where the power line bends through it and then follows its extension south to the Lehigh power take-off. Another large slot in the same limestones 400 feet farther east splits the north end of the high hill three-fourths mile northwest of Alsen. All these parallel slots are out of natural relation to drainage but they do accord with the direction of glacial flow as well as that of master jointing. They deserve further study.

EROSIONAL STRUCTURES

Under this seemingly contradictory title will be discussed features that are sufficiently stratigraphic to have no place in the scheme of physiographic classification yet exist only by virtue of erosion, namely outliers, inliers, faultliers and fensters. These show upon the map as isolated patches of color.

Outliers are patches of rock sundered from the main mass by erosion and surrounded therefore by older rocks. Commonly they occupy the troughs of synclines. Inliers are unroofed exposures of older rocks looking up through a rim of later ones. Commonly they occupy the crests of anticlines. Faultliers are disconnected patches torn from the main mass by faulting, and may rest upon either older or younger rocks, or both. Fensters ("windows") are inliers of younger rocks looking up through a rim of older ones in a superior fault slice.

1 Outliers. The largest outlier of Silurian and Devonian rocks in the Catskill quadrangle is Becraft's mountain southeast of Hudson, with all formations of the Kalk Berg belt except the Rondout. It is described separately by Doctor Ruedemann, on whose side of the river it lies. On the west side, a smaller one is Eagle cliff (figure 16) in Austin's glen, carrying Rondout, Manlius, Coeymans and Kalkberg limestones wholly surrounded by the Ordovician (Normanskill). The Limekiln hill just west of Flatbush, near the south edge of the quadrangle, supports a Manlius outlier and that northwest of Schoentag's a Becraft outlier, north of which is a small but spectacular outlier of Kalkberg and Coeymans. A large outlier of Onondaga limestone lies in the meadows northeast of Katsbaan Church and the map shows three other good-sized and one tiny (doubtful) outlier of this rock farther north, three of which are in the diagonal syncline running west of north from Van Luven's lake. The most northerly one contains Palmer's (or Cauterskill) cave. Northeast of the last is an elongated outlier (the only one) of Schoharie limestone.

Another Becraft outlier lies high on the hill east of Austin's glen, with a tiny one north of it (at Dick Hartley's and onto Otto Margraf's land), extending a bit over the quadrangle edge, while a third one enters the map east of that and close to the east front of the Kalk berg. An artificial outlier of Becraft has been made by quarrying, west of Cementon, just south of the Alpha crusher. A typical outlier of Kalkberg and Coeymans, though riding on a Manlius fault block, caps the hill south of the Red Schoolhouse, above the "big spring" on route 9-W.

Thus of true natural outliers on west of the Hudson the Onondaga limestone has five, four of them large, the Becraft has only four, not so large, the Kalkberg and Coeymans three, the Manlius but two, one of which it shares with the Kalkberg-Coeymans and the Rondout (in Eagle cliff), and this is the only one of Rondout. The Schoharie also has just a single but large outlier, making a total of 15 for the Catskill quadrangle, including Becraft's mountain. Not a single outlier or even sundered fault mass is known for the Esopus, the Marcellus, the Mount Marion, the Ashokan and the Kiskatom beds in our area. Nor are there outliers of Catskill shaly limestone.

On the other hand, the mountain peaks of the Kaaterskill quadrangle carry large and striking outliers of all the succeeding formations (Kaaterskill, Onteora, Stony Clove and Katsberg), as the map shows so well that they do not require enumeration (see figures 52, 54, 55).

The list of outliers on the Catskill quadrangle may be incomplete. It is not at all certain that the patch of Onondaga limestone north of Lost brook, halfway between Saugerties and the peak of Mt Marion, may not be isolated, as shown in the alternative mapping, instead of connected beneath the clays. Three small synclines on the east ridge of the Kalk berg above route 9-W though mixed up with faulting seem to have been natural outliers of Alsen and Glenerie beds. The simplest and largest of these is the middle one, at Van Luven's lake, which has been jammed over upon the Esopus and thus lost its western edge in the fault. Under the big overthrust hill (figure 69) at Alsen runs a long narrow syncline of these same beds, north to the south quarry (figure 68) of the North American company. A shorter strip looks out at both ends from under the derelict hill north of the Streeke, northeast of the Red Schoolhouse. There is also a linear synclinal strip of Glenerie chert midway of the ridge, a third of a mile back from Alsen, but in slight contact (faulted) with an unrelated Glenerie strip on the northeast end.

2 Inliers. Being generally more infrequent than outliers, inliers attract more attention. On the Catskill quadrangle they almost outnumber the outliers, without including artificial ones.

Largest of these and of unusual beauty both on the map and in its ruggedly cavernous Becraft limestone surfaces, is Mr Mower's hill, the Sup berg, a mile and a half north-northwest of Saugerties. This is an inlier of Alsen and Becraft. A third of a mile west of it, on Mower's crossroad, the Esopus is unroofed east of route 32 between two ridges of Schoharie tailing south from the hill on north, but is not exposed through the glacial till. Another inlier of

Alsen and Becraft lies five-eighths of a mile west by north from Van Luven's lake, north of Percy Holmes's house, and is partly rimmed around by sinkholes, two of which swallow brooks just west of Mr Klee's entrance.

In the Streeke fenster, the Becraft makes a tiny eye through the Alsen (see page 176). A similar inlier of Becraft pinched up through the Alsen on the hill south of Schoentag's has its south end overridden by New Scotland beds; but pushed right against it is a companion pinch of Kalkberg up through the Catskill shaly. An eighth of a mile northwest of these is the Manlius inlier cut through by route 9-W and a brook, in the core of a slightly ruptured anticline. There is another up-pinched rib of Kalkberg limestone 500 feet northeast of the natural dam (figure 78) in Austin's glen. Nearly half a mile southwest of this natural dam, along the old railway grade, the Schoharie pokes up under the arch of Onondaga limestone and probably extends south beneath the clays across the Cauterskill-Leeds road.

The pinched rib of Rondout limestone at the north line of Saugerties has been mentioned (pages 46, 53, 173), and it is to be noted that all such buckles, including all those above listed, are associated with overthrusts, perhaps as part of the takeup. A similar though somewhat mashed pinch of the Catskill shaly that seems to have been naturally exposed but has been more largely developed by quarrying lies between the old and the middle Alsen quarries, cut through by their railway.

Most interesting of all, because unique, is the inlier of Normanskill in Silurian beds three-eighths of a mile due north of Schoentag's. Glacial drift and grassland cover all but a doubtful square foot of exposure, but the disposition of the surrounding Rondout waterlimes is such as to leave no other possibility than a fair-sized inlier of the Ordovician. This is on the north end of the same ruptured anticline as the Manlius exposure of route 9-W, but the slight faulting is in no wise responsible for the inlier in either case.

A glacial moraine at Mr Dederick's, one-half mile north of Katsbaan Church, prevents certainty as to whether the Schoharie here closes over and makes another large inlier of Esopus north nearly to Asbury. A mile north of Asbury the broad expanse of Onondaga limestone over a double anticline shows no interruption with the exception of a small strip in plowed field and north into woods where the basal Onondaga stratum is in such relation and so glacially disrupted into boulders as to imply a small inlier of Schoharie, without known exposure.

Although rock is concealed, the visible depth of the clay-filled valley at Lost brook, a mile and a half southwest of Saugerties, is such as to make inevitable a trenching to the Esopus down through the Schoharie arch. Southwest of this, on the west side of the Old King's road at the crossroad to the base of the Mt Marion, is an "island" of Onondaga limestone, rising as a perfect elongate dome through the Lake Albany clay, that might be termed an inlier in the Pleistocene.

Quarrying in the cement region has several times gone through the Becraft and made inliers of Catskill shaly. A large one of these shows on the map, south of the county line, in the back Alpha quarry west of Cementon. The still larger one at Alsen may have been originally natural and is listed above. There is a small one mapped at the entrance to the northwest North American quarry south of Van Luven's lake and another too small to map upfaulted in their south quarry on its west side.

3 Faultliers. Generally sufficiently evident upon the map, the faultliers of the Kalk berg in the north half of our area are too numerous to specify. Many of them have been discussed in the section on faults. Most conspicuous, and economically most consequential, are the long strips of Becraft in the cement region. While in some respects the faulting here has hindered operations, particularly by interpolating the flinty and worse than useless Glenerie, on the other hand it has kept near the surface and presented for removal a much larger amount of high-grade limerock than would otherwise have offered.

To what extent such masses, disconnected on the surface, have underground continuity can in most cases be known only by exploration with the drill. As yet, the quarries have not demonstrated such continuity save for the slight "snaps" (figures 65, 66, 68). But in some cases drilling seems to have done so.

The large patch of Onondaga limestone on the latitude of the Pine Grove school, listed as an outlier, should perhaps be called a faultlier, for the Schoharie is thrust upon its east margin. To the imbricated structure of the Kalk Berg front is due many fault-isolated strips of Manlius, of Rondout (Fuyk), and of Coeymans-Kalkberg beds margining route 9-W, some of them partly concealed and inferred. The most interesting relations are at the conveyor-underpass of the North American plant: the lower slice begins with Fuyk sandstones down by the West Shore tracks and ends with the Coeymans making a fine cliff just east of the highway summit; the upper slice begins with (reworked?) grits exposed slightly in the west road gutter just north of the underpass and concealed under its concrete, followed

upwards by Fuyk etc. This is the only case known to me of possible Normanskill infaulted with the limestones (and sandstones) of the Silurian, but is too crowded to map.

In the south half, except the two marginal cases described on the hill south of Schoentag's, there are but two faultliers. One is a tiny patch of Coeymans southwest of the larger Coeymans-Kalkberg outlier a half-mile north of Schoentag's; the other a long strip of Manlius-Coeymans-Kalkberg in the north half of Canoe hill, Saugerties, above crags of New Scotland west of the rifle range.

4 Fensters. A fenster is a window in an overthrust slice, revealing what is beneath. The cement quarries have made three of these, each time exposing Glenerie chert beneath overthrust limestones, but two of these have subsequently been breached through the rims on the west, namely in the middle and west (or tunnel) quarries at Alsen, making T's of them on the map. In the original or northernmost quarry of the Catskill Cement Works (now Alpha) at Cementon the mass of Glenerie chert encountered in the quarry floor was finally uncovered southward, with its slickensided hummocky surface rising fast, over a space of five by ten rods before the quarry was abandoned, with the rim unbroken.

Not so easily distinguished on the map is our one natural fenster, east of the Streeke Lake depression contour (see page 176), accessible by a farm road west from the top of the road hill above the Red Schoolhouse. The bottom sheet of Becraft and Alsen is here completely rimmed around by the second slice of these same rocks, but, as the Becraft fails to carry across the west rim for about 400 feet, Alsen there is in contact with Alsen and the colors merge on the map. Nevertheless, this is a true fenster, a thousand feet long and over two hundred feet wide, ending southward in a cattail swamp.

5 Fault floors and fault swamps. Tramping the rugged and generally rocky ridges of the Kalk berg, one frequently comes out on broad featureless and exposureless surfaces, from a few rods up to a half acre, often cleared or natural meadow or shallow cattail swamp. Almost invariably such a surface proves to be the glacially stripped floor of an overthrust, and often it is most annoying to the mapper of the rocks. For it is wholly noncommittal—the hardest, or the weakest, rock may be under it. Here one man's guess is as good as another's; the map can express only the weight of probability. Just why they should be so lacking in exposures is a problem for some one to solve.

FEATURES DUE TO GLACIATION

Without attempting to cover all the glacial geology of our region, some outstanding examples of the effects of glaciation may now be mentioned as essential elements in our physiography, and also to emphasize the very minor role played by the glaciers in the making of our geography.

GLACIAL EROSION

The largest effect of the ice sheet upon our area was doubtless that of erosion and removal of material—chiefly the soils and rocks deeply rotted through long preglacial time. After viewing the depth of such rotted material in our nonglaciated Southern States, one reasonably accepts a hundred feet as by no means an impossible maximum depth for such ice erosion, with a likely average of from 25 to 30 feet. Such an estimate is supported by the amount of glacial drift heaped into the moraines farther south or left nearer home.

The great blocks, often of several tons weight, of our local limestones that occur as far south as Long Island show that the ice also tore loose such jointed rock-masses of undecayed material, mostly from projecting ridges or cliffs, and carried them away. This would have tended to reduce the ruggedness of the surface. In some cases there seems to have been also a tendency for the ice to scoop softer rocks out of hollows. Normal surface erosion ought to have left many isolated remnants of Bakoven shale in the Onondaga synclines, of Esopus shale in the Glenerie synclines, of Catskill shaly limestone in the Kalkberg limestone synclines, as well as hilltop cappings elsewhere. Not a single such outlier of these formations is known today in our area.

Instead, there are often undrained or clay-refilled hollows where these rocks should be and may formerly have existed, such as Van Luven's lake, the marshes on the West Camp syncline (which, being narrow, are not shown on the topographic map), clay-filled synclines along the Old King's road near Saugerties and Asbury.

It seems inevitable, furthermore, that the ice deepened and straightened the Bakoven valley in the soft black shale (figure 40), increasing the rectilinearity and the steepness of the Hooge Berg front (figures 2, 3, 73). For not only does this "strike" valley run in the same general direction as that in which the ice flowed, but the glacial gravels along its course are well filled with pebbles of the black shale itself—pebbles necessarily derived from perfectly fresh rock (to stand the wear) and only subsequently rotted (see page 191).

That being true of the Hooge berg (figure 3), we are led to inquire to what extent the renowned "Wall of Manitou" or mural front of the Catskills (figure 5) is the product of glacial erosion. Here again we have a weak-rock belt at the foot, namely thick masses of red shale with interlarded heavy flagstone ledges split lengthwise by great master-joints parallel both with the (present) mountain front and with the direction of ice movement. There is, moreover, a curiously fresh and abnormally regular appearance to these parallel steplike ledges with such immaturity of the drainage upon them in a segment of a circle swinging from the base of Overlook mountain to that of North mountain for two miles east of West Saugerties and of Palenville (out as far as Saxton and Lawrenceville on the Catskill quadrangle) as reasonably to suggest a preglacial conformation of the mountain front actually so rounded out eastward to the extent of two miles.

Even the inadequate contouring of the 35-year-old Kaaterskill sheet shows the contrast in topography and drainage between the piedmont segment thus delimited and the continuation of the same strata (with equally high dips of three to four degrees) around southwest past Woodstock and, for the little section within the map limits, in the opposite direction around northwest of "Sleepy Hollow" (Rip Van Winkle clove). In addition, along the entire linear front of the mountains, which is visibly straighter than the map depicts it, all the mountain spurs are sharply truncated, as they are not in the recurved sections to north and south.

If this suggestion in the topography is trustworthy, then we can postulate that the ice, in its several occupations of the Hudson valley, being crowded by this huge protruding front of the Catskills, took advantage of the weakness of the flagstones in their powerful parallel jointing and their interlarded soft shales to whittle back the obstruction and eventually plane away the mountain front to its present position, for a maximum distance of two miles.

There are two peaks that in the configuration of their summits show the effects of this process. One is Overlook, which is only a half-peak for erosion on the east has eaten back to its crest. The other is Pine Orchard mountain, namely the little eastern peak of South mountain directly south of the Mountain House, which has been more than half cut away, as is seen when it is viewed from the North Mountain paths.

Ordinary atmospheric erosion seems inadequate to account for the straightness and abrupt declivity of this long mural front. Doctor Clarke's interpretation of it (1915*b*, p. 156-57, 160-61) as due to

"rifting" by solution of underlying limestones loses weight when it is seen that the limestone outcrops are over five miles away to the east (on another quadrangle), and that the intervening country is not rifted. Hence we are left with the Hudson Valley icelobe as the likely agent, great as is the volume of rock (over a cubic mile) that seems to have been removed. But it is reasonable to ascribe most of this work to the earliest (Jerseyan) ice invasion rather than to the latest (Wisconsin).

Another striking piece of ice erosion is found in the cross-notches of the mountain ranges, a fact first pointed out to me by Professor Albert C. Hawkins, formerly of Rutgers College, as he observed it from Skytop tower on the distant Shawangunk mountains. Each such valley has been widened to a U shape (figure 71) by the ice pressing through in its southward movement. Normally all these valleys would have been V-shaped in cross-profile, as are the Kaaterskill (figure 7) and Plattekill cloves which lay transverse to ice flow.

The sawtooth profile of many peaks (figures 4, 5), all the teeth pointing southward as viewed from the east, has also found explanation in the unequal effects of ice erosion upon the "struck" and the lee sides of hills that the ice overrode, grinding down the former slope to a less angle but steepening the other by plucking away whole masses of rock. The dip of the mountain strata is insufficient to account for these sawteeth, though it does bring certain specially hard and thick beds to the summits of all the peaks that show this form, and in many cases the form is just as plainly seen from the north, pointing east, as for example in High peak and Roundtop (figure 52) south of Haines Falls. Nevertheless, the ice unquestionably did the final shaping.

GLACIAL AND GLACIOFLUVIAL DEPOSITS

The ice-eroded material came to rest in various forms. During ice movement, but probably after the ice had grown thin, drumlins (whaleback hills of glacial till) were formed underneath it by a process of upsqueezing and upbuilding (plastering on), the mass kept smoothly rounded by flow of the ice over it. These drumlin hills, conspicuous north of our map from Greenville into the Helderbergs, are uncommon on our area but the summit of Bethel ridge is a fine large drumlin, beginning 500 feet south of the schoolhouse and extending for half a mile south. It overtops anything within two miles of it.

There are also drumlin-shaped hills for a few miles east from the Hudson river in the townships of Germantown, Clermont and Red

Figure 71 U-shaped (glaciated) notch through the central range of the Catskills—Mink Hollow, near Elka Park, as seen from western part of Tannersville. Plateau mountain on right, Sugarloaf on left (see figure 54). Note rimming ledges of Stony Clove sandstones. Gap was originated by stream erosion along a keystone fault, then was widened by the ice. Looking south by west. Photo: April 1938, W. J. Schoonmaker.

Hook, some of which may be true drumlins while others are doubtless shale hills given a similar form by ice erosion—in short, they are rocdrumlins. The distinction between the two kinds (of opposite origin, the one built up, the other ground down) can be made on the ground by the nature of the component material: bouldery till in the drumlin, rotting shale in the rocdrumlin. Many true drumlins have rock cores or noses.

Beneath the ice also were formed eskers, namely gravel ridges, usually winding, that were the beds of subglacial streams flowing in ice tunnels under the glacier. Since they usually follow the bottoms of the valleys that run in the direction of ice flow, as ours do, a large esker should be expected down the middle of the Hudson valley, perhaps in the river channel itself. If such is there it has not been detected. In the Bakoven valley, however, there is an interesting esker awaiting further exploration.

This, which we may call the Quatawichnaach esker, is twinned—a double ridge of gravel rising higher than the clay-plain in the stretch west and northwest of the Green Schoolhouse, as the contours plainly show. They show also the deep gulch that has been cut across the west half of this esker by a tiny brook. The spot is easily reached and worth visiting. From the Old King's road may be seen a gravel pit that has been worked in the fragment north of the gulch.

Though carved up by the Kaaters kill, the same esker, or rather its gravels beneath the clay, can be seen again just south of the road bend beyond Quatawichnaach, where a fresh pit reveals much Bakoven black shale in pebbles. Actually the gravels continue north in the ridge to the bridge and resume across the creek under the clay knoll just where the farmhouse road turns in northwest. On the north end of this clay knoll this esker has been reuncovered by erosion of the clay and makes a nice little ridge again with a gravel pit on east side that likewise has numerous Bakoven shale pebbles. North across the creek, opposite to a house, is a further piece of it. Shale gravels (Chadwick 1910*a,* p. 28) that may belong to the same esker are dug two and one-half miles farther north, on the road that goes up under the east face of Vedder's hill, but the intermediate tracing has not been attempted. Here is a pretty little job of mapping left for someone to do.

A long way south in the same Bakoven valley is another (or is it the same?) good esker, though involved with the cuesta-ridge of the hard basal beds of the Mount Marion formation. On first one and then the other of these runs the road northwest from Mt Marion hamlet to Veteran. The esker section, characteristically serpentine in its

course, is all within the first mile from the highway intersection. No eskers have yet been found on the Kaaterskill quadrangle.

The termination of the rivers running out from or off from the ice into standing waters (such as glacial lakes) is usually indicated by gravel deposits of other shapes. When these are more or less rounded knolls, singly or in groups, they are known as kames. A pretty little kame, shaped like an inverted bowl, lies on the west of route 385 just south of the first public road branching west (Harvey Brown's) north of the Rip Van Winkle Bridge intersection, namely at the "148" corners. A remarkable kame a hundred feet high is prominent on the map, a mile east-northeast of Blue Store. A very typical large kame at the north entrance to the Stony clove is supplying abundant gravel for the town roads of Hunter (compare Rich 1935, figures 19-20, p. 142-43). Beyond the notch are other kames, near Edgewood, (Rich 1935, p. 81-82).

More frequently the glacial stream gravels were spread out in plains, broad or narrow, not uncommonly today making a terrace with the drop-off on the side toward the vanished ice. "Pitted" gravel plains with undrained hollows (kettle-holes, not to be confused with potholes; see page 221) are surely glacial, with buried blocks of stagnant ice left to melt out afterwards. Largest of these plains on our maps is the one extending from Twin lakes past Manorton and Livingston to Bell pond (Woodworth 1905, p. 121-22, 256, plates 7, 28 No. 11), as discussed by Mr Cook in his chapter (Part I, pages 202 to 209). No such pitted plain, (except a very small one with a single kettle noted by Mr Cook at mouth of Stony brook), has been found on the west side of the river in our area. Doctor Rich (1935, p. 41, 84, 85, 97) has mapped kame terraces (without kettles) northeast of Kaaterskill junction and northwest of Lake Hill, and a prettier one on the north side of the Little Beaver kill one mile west of Yankeetown, besides others, all on the Kaaterskill quadrangle.

In the kettle-holes of the pitted plains lie numerous lakes, of which Bell pond is the largest lake on the Catskill sheet, rivalled in our area only by Cooper's lake (natural limits) on the Kaaterskill sheet. The Twin lakes and Warackamac, also the Spring lakes, besides many smaller unnamed ponds in the same gravel plain, are kettle lakes.

Most of our lakes, indeed, are a result of glaciation, since all lakes are temporary features of the landscape. Like Van Luven's lake (page 186), North and South lakes ("Kaaterskill lakes" of Rich 1935, p. 21-22) at the Mountain House appear to be in glacially excavated rock-basins, but they have been enlarged artificially by damming, and Echo lake north of Overlook mountain may be likewise

a rock-basin lake; yet both it and North lake are suggestive of cirque-lakes, and both Echo and South lakes are mapped by Rich (1935, p. 85) with thick drift moraine blocking the outlets, which opens a little problem for field study. Cooper's lake is distinctly a morainal lake (Rich 1935, p. 84), held up naturally by a morainal dam on the east (but lately greatly enlarged artificially). So is the lower lake on the Colgate estate above East Jewett, the blockading dam here being mapped by Rich as a drumlin, whereas their upper lake was purely artificial. The little pond at Mead's is likewise morainal, and so perhaps is that on Church's hill, besides surely the tiny one back of West Camp cemetery. Such of the remaining lakes or ponds shown on our maps as are not man-made are mentioned beyond under other origins.

Our region has been said to be lacking in good glacial moraines, at least in the Hudson valley, but this is only partially true. There are certain moraines of very interesting character even in the valley. In the mountains are conspicuous loops (now breached by streams) across the valleys and, except in the main Schoharie Kill valley, the curvature of these loops shows that they were built at the tips of ice tongues spilling westward from the Hudson Valley ice lobe. The Schoharie Kill loops, nearly to the divide at its head, are all convex southward.

Specifically, there is the morainal ridge rising to over 2100 feet elevation northeast of Kaaterskill Junction (partly a kame) and holding behind it a brook that runs towards Tannersville. Northwest of this, lower and later, is the moraine at 2000 feet damming the "Shanty Hollow" basin of Mossy brook on the one side of the valley, coming down as a long snout from the East Jewett range on the other side of the valley (between Hunter village and Hunter notch), and finally crossing the valley bottom just northwest of Kaaterskill Junction. To ascribe parts of this moraine to local glaciers as Rich's map does seems unnecessary and his argument (1935, p. 97) unconvincing.

Farther southeast and older are the loops at Elka Park, particularly the big one (partly kame) that turns Roaring brook so far eastward to meet the Schoharie kill. There is another good one a mile south of this, with half-mile segments of its arc on each side of the valley. Within less than a mile east of that one, however, is a similar moraine but of opposite curvature, made from the Hudson Valley side; up its south segment runs the trail to Indian Head and to Overlook mountain.

The loops at Tannersville and east of that village also round westward and were built from the east, as shown on Rich's map for the

large group around Haines Falls. So does that at Colgate's lake, besides others farther west on the East kill. But the Beach's Corners moraine and seemingly one at East Jewett church were formed from the west by a tongue of the Schoharie lobe.

The moraines partly encircling Cooper's lake and forming its dam on the east are convex westward and northward, therefore terminated ice tongues coming from the east, the Hudson valley, one by way of Woodstock and Baehrsville, the other down the Saw kill from Echo Lake pass. At an earlier, higher stage, when these tongues coalesced, was built the big morainal plug west of Willow that forces the Beaver kill south into the rock wall of its valley (route 212).

For a fuller account of the glacial deposits and glacial features of the entire Catskill Mountain region, including the Kaaterskill quadrangle, the reader is referred to Doctor Rich's bulletin, number 299 (1935), above mentioned, except that so many unproved local glaciers are not being generally accepted.

In the Hudson valley the moraines are smaller but often much less eroded and prettier for study. A particularly interesting series of them lies west and southwest of Bethel schoolhouse, towards Kiskatom. Here as the thinning ice began to split around Bethel Ridge drumlin it made a succession (down the slopes) of long low ridges or morainal welts, declining slightly south on both slopes, east and west. With stronger ice flow on the east, at first, the moraines from that side are bent westward around the south end of the drumlin as the contours show (a few of these ridges are, however, of rock), to coalesce with those from the west. All the ridges continue southwest, the lower ones on the west side of the brook making concentric loop after loop, a third of a mile north of Kiskatom, then returning northward against the rock ridge on the west side of the brook. Thus the moraines are nested one into another northward. The later ones, south of the Lawrenceville road, are especially well shaped and of coarse flagstone debris between the road on east and the brook, making an interesting series to examine; but the loops at the south are the most unusual portion of this extensive display. The making of such moraines requires ice whose forward motion has not ceased.

Another series of morainal ridges, visible even in the contouring, sweeps around the southeast end of Cairo Roundtop, northwest of Lawrenceville, and is crossed at its tips by the road running up the east side of Kiskatom Creek valley. Parts of this series can be picked up again on the south side, near the schoolhouse. Again there is a series lapping off the south end of Timmerman's hill, a striking boulder-moraine of Rondout limestone blocks tails south from the

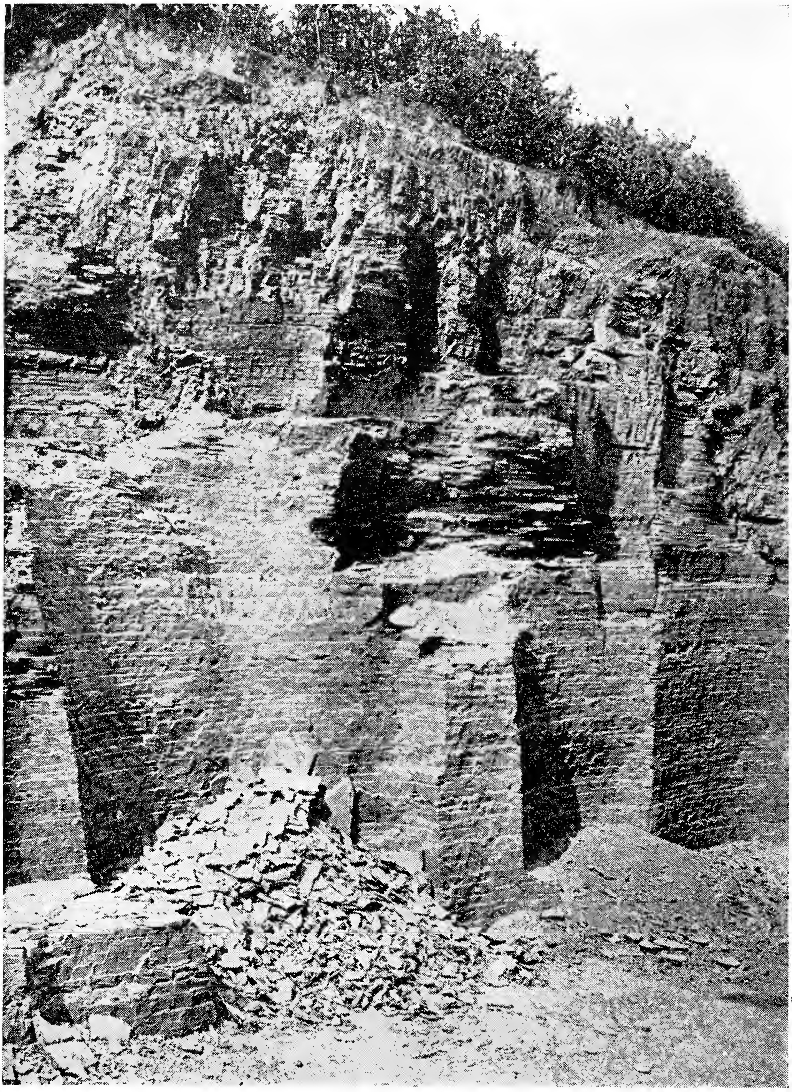

Figure 72 Varved Albany clays in north end of Washburn's upper brick-yard pit (now high school site), West Catskill, a part of the Cats Kill delta in Lake Albany. Face artificially excavated. Top brecciated by slip and creep. Looking northwesterly. Photo: About 1930, R. W. Jones.

Flatbush hill and a pretty moraine crosses the Bakoven valley at the north edge of the Catskill quadrangle in sight of Leeds, looping from the Hooge berg at Vedder's hill eastward across the Cauterskill-Leeds road to the Kalk berg and carrying the Vedder road on its back.

There are, besides, many lesser examples, too numerous to list, on the west side of the river; as near to it in one case as that which turns east from Rushmore's hill across route 9-W and the railway, half a mile south from our north line, and continues southwest of the Corlaer's kill to the hilltops southwest of Hamburg. The presence of such a moraine means that there could not have been any large body of stagnant ice on the west side of the Hudson. The evidence for smaller stagnant masses is given beyond.

On the east of the Hudson the situation is unquestionably different. Instead of moraines are pitted gravel-plains and other evidences of torpid ice melting away *in situ*. What looks from Catskill like a large "lateral" moraine extending high along the east bank of the river from Mt Merino south past Greendale station and cut through at the east end of the Rip Van Winkle bridge is, according to Mr Cook, a succession of drumlins *en echelon;* and, if ever a moraine, has been overridden and drumlinized, therefore is older than the final melting stage of the ice.

While the glacier itself built moraines and drumlins out of its own unsorted grist, its escaping meltwaters made the eskers, kames and pitted gravel-plains of sorted, water-rounded materials. These consist, however, only of the coarser stuffs—gravel and some sand. The finer material, namely silt and clay (rock flour) drifted farther afield, mostly into large bodies of standing water the major and final one of which we call "Lake Albany," (Woodworth 1905, p. 175). Here the pulverized stuff settled slowly, far out from its icy source, and made the beautifully layered or "varved" clays (Woodworth 1905, p. 180-81; Antevs 1922, p. 46, 67, 83; see figure 72) that have been the foundation of our brick and tile industries. On top of these, as the water was shallowed by them and by land uplift, silts were spread and often finally coarser sands and gravels. Large sources of at least this final capping were the creeks coming off from the newly reuncovered lands, particularly the Esopus, the Jansen kill and the Cats kill.

The Lake Albany delta of the Roeliff Jansen kill is the broad plain at Linlithgo and southward past Burden, with a marginal elevation now of about 150 feet. It must be remembered that all deltas have a sloping surface, often far out under water, and continued landward (Chadwick 1910*a*, p. 28) as a slowly rising floodplain (grade-plain). Thus the Mississippi delta reaches out beneath the Gulf of Mexico

well beyond navigable depths before it drops steeply off, while its true head is at the mouth of the Ohio, 630 feet above sea level. So our Lake Albany deltas rise headward, and for the additional reason that the Lake Albany level was presumably already slowly lowering as the land rose (see page 212) and as the delta was being extended outward. The true head of the Jansen Kill delta may therefore be placed as far upstream as the former grade-plain reaches, at least to Blue Store, probably to Clermont.

Similarly the Esopus delta, underlying both Saugerties and Glasco and now bisected by its parent creek, has a front margin at about 140 feet altitude above tide but rises through the Lost brook and Glenerie passes to levels over 170 feet elevation in the Bakoven valley behind the Kalk berg. (Sands and fine gravels cap the debouchure of this delta, south of the Oak Ledges, Saugerties, where its altitude is nearly 150 feet.) Its contributory, the Sauger's kill from the north, grades its clay meadows up to the same elevation where they merge with those of equal height in the Bakoven valley at Percy Holmes's place west of Van Luven's lake, and also southward through the archipelago of ridges until they similarly merge at Churchlands northwest of Saugerties. Blockade of the Great Vly (Vlaie) by this Sauger's Kill grade-plain entrapped the swampy lake that occupies the Vly.

In short, no separate origin can be argued for the seemingly higher clay plains in the Bakoven valley. While deposition may have begun there earlier, as it was first to be relieved of ice, such deposition ended contemporaneously with that of the lower portions of these plains nearer the Hudson. All are ascribable to one receiving body of open water, Lake Albany. The higher alcove deltas of earlier date will be mentioned beyond.

Largest of all these Lake Albany deltas in our area is that of the Cats kill (Chadwick 1910*a,* p. 28) reaching in its prime from the mouth of Austin's glen (actually from above this glen, off our map) south to the Great Imboght. Its surpassing size is due not so much to superior volume of the combined Cats kill and Kaaters kill, for this does not match that of the Esopus, but to augmentation of the Cats kill at that time by large glacial rivers coming around the Helderbergs from the Mohawk valley and perhaps from the Adirondacks. The channels of these rivers, and their high-level gravel deltas into the Cats Kill valley, are on the Coxsackie quadrangle next north.

Marginal elevation of the Cats Kill delta, now divided by the creek that made it into two large remnants—one in Jefferson Heights, the other in West Catskill—is barely over 80 feet at the Imboght,

Figure 73 Eroded remnants ("bake ovens") of Lake Albany clays on both sides of the Bakoven (bok-o-fen) valley four miles west of Catskill, on the Rip Van Winkle trail. Compare figure 74. Distant houses are on the clay, which crosses the valley at a higher level in far right. Hooge Berg range on left (see figure 3). Modern floodplain of the Kaaters kill in right foreground. Looking north. Photo: April 1938, W. J. Schoonmaker.

Figure 74 The original Bak-oven (Dutch, "bake oven"), in center of view, at the ancient stone house of the Abeel family (scene of Brandt's raid), about a half mile south of figure 73. Valley underlain by soft black shale. Looking north, from rear of the house. Photo: August 1938, G. Arthur Cooper.

but the delta rises to over 180 feet at the Austin stone house, a decline of one hundred feet southward in four and a half miles. This is not a continuous grade, however, but about forty feet of it is accomplished in one jump, from the north remnant at 160 feet to the south one at 120 feet, though with a tiny portion of the 120 foot level remaining on the north side, near the route junctions, as proof of the drop.

In short, we have here two deltas at different levels, in the lowering waters. The north remnant, in Jefferson Heights, is the earlier and higher delta, built chiefly eastward (across the Hans Vosen Kill valley) with lobate front forcing that brook over into the rock wall. This plain is topped by fairly coarse sands (note the cemeteries) even to its south margin, and these coarsen to gravel at its head (Austin's); but thick varved clays underlie all its mass and cause landslides on west and south sides facing the Cats kill (figure 60). Contemporary with it was a filling of the Bakoven valley directly west, that rises also to over 180 feet (figure 73) where it connected through the old railway pass to Austin's glen at the north edge of the map.

On completion of this Jefferson Heights delta, which had crowded also the Kaaters kill against the rocks because the latter was dropping its own burden up near Asbury and therefore flowing clear (from a lakelet in the Bakoven valley) the Cats kill happened to have swung to this south or Kaaters kill side of the delta as the lowering of the Lake Albany waters caught and held it there to intrench, and to begin building the lower, larger West Catskill delta from the West Shore station south to the Imboght. (See figure 72.)

Just what part stagnant ice (Woodworth 1905, p. 81 figure 4; 84-85, Cook 1924) may have played in this rather sudden shift of level is not yet evident. In this alcove of the preglacial Vosen Kill valley, then reaching south to the Imboght, there was ample catchment for dead ice; but the higher north sector of the delta does not itself show any sign of the presence of stagnant ice. It was finished in open waters on an ice-free foundation. That ice may have lingered under West Catskill, however, and for a time obstructed delta-building is a possibility, though unproved. This plain also has its sand-capping, so was completed by the creek, and its well smoothed top shows no sign of settling over buried ice. But, on the other hand, along its east margin from Green (Van Orden's) Point north to the Kykuit rock knob the presence of much stagnant ice is demanded to account for the long hollow that makes a nearly linear edge to the main mass of the delta and separates from it a huge sand ridge (moulding sand)

and unburied rock ridges on the east, towards the river. There are not the cut banks to this hollow that it should have if a part of the Hudson river once ran through it, yet it is refilled and its original bottom must go below the river level of today.

The anchored ice block thus postulated must have reached also south into Duck cove. It, and the natural termination of the delta at this point, explain the presence of the Great Imboght, including the cove. Moreover, although the apparent absence of an esker argues for persistence of ice flow in the main channel (inner gorge, Woodworth 1905, p. 71) of the Hudson until the ice there became fairly submerged under Lake Albany, yet that ice too must have stagnated at the end. None of the raised deltas protrude at all into this fairway of the Hudson, or show evidence of having cut-banks towards it as if they had once so invaded.

This is true not only for the Cats kill, Jansen kill and Esopus, but also for the delta plain (140 feet) of Stony creek at Madalin and eastward that fails to fill North bay but grades up to over 200 feet elevation at Elmendorf school, and of the Saw Kill delta (140 feet) at Annandale that fails to fill South bay. It is equally true at Albany and southward of the great delta of the Iromohawk, north of our area.

Certainly these facts spell ice blocks in the inner gorge of the Hudson, submerged under Lake Albany. But that lake had open waters and wave work. There is reason to think that it beat against and bared the limestone and Normanskill cliffs around Cementon, Alsen and northward where its waters were least obstructed by shoals. Professor Fairchild (1919, p. 35-36) reports definite beaches of Lake Albany on the north slope of a glacial hill southwest of Becraft's mountain, near Mt Pleasant church (formerly Greendale), and especially a large gravel bar on route 9 at the "245" corners south of the city of Hudson. But a water level at (present) 240 feet altitude is all that is required by these beaches, not the 275 feet that Fairchild (on old data) here assigned to Lake Albany. A detailed examination of the abandoned shore line may reveal many significant features hitherto neglected.

GLACIAL VESTIGIA

Glaciated surfaces, always interesting, are common in both of our quadrangles but generally better preserved in the valley. On an unusually good large glaciated surface of Kiskatom sandstone at Bogardus's corners north of School No. 7, Kiskatom, there are, in addition to the usual striae, several finely preserved series of chatter-

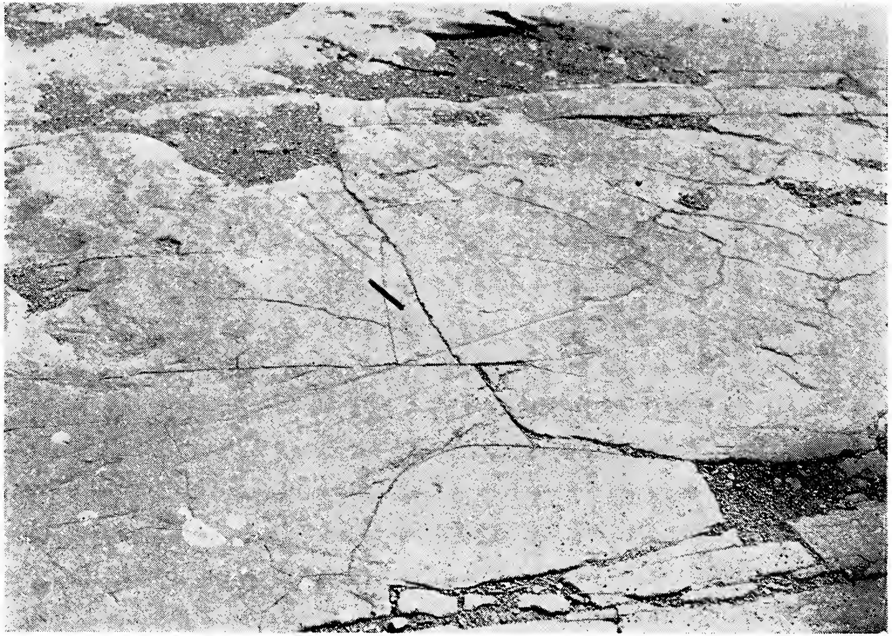

Figure 75 Glaciated surface of Kaaterskill sandstone at former Otis Summit, north of the Catskill (Andron's) Mountain House. This ledge is at junction of service roads (formerly Little Delaware turnpike and Mountain House stage-road) of North Lake Recreation Park at rim of Hudson valley a few rods east of the parking area. Surfaces in general strongly striated westward (toward us) by last ice movement, from direction to which the pencil points. In protected (lee) foreground, strong remnants of earliest striation at right angles to the latest. Right of center a few traces of striation in intermediate 45° direction. Looking southeast toward Hudson valley. Photo: April 1938, W. J. Schoonmaker.

marks—crescentic flaws three or four inches across nested closely one within another and due to the chattering movement of boulders as the ice dragged them slowly over the rock. The ends of the crescents always point in the direction of ice movement, here west of south. Half a mile south-southwest, on route 23-A at a filling station, is another good glaciated surface partly blasted away for the road.

Glacial striae on the mountain front (Wall of Manitou) run horizontally along the face of the ledges. On the north end of Quarry hill, Catskill, a Normanskill sandstone exposure up south of the elbow in the Kaaters kill has striae that run straight and steeply up the hill in a direction still parallel with those of the mountain front. The same direction holds all over the mountain divides and peaks, showing how little topography affected the rigidity of onward flow when the ice was thickest. But when mountains or hills reemerged as islands in the waning ice, then the glacial flow had to divide around them. Still later, when only tongues remained in the mountain valleys, these even turned back toward the north. Thus on the north rim of the Kaaterskill clove, especially along a now abandoned carriage road (shown on the map) southeast of the burned Hotel Kaaterskill, they run northwesterly, indicating movement into the Tannersville valley from the Hudson Valley ice lobe, as Rich's map shows.

A most interesting case in point exists on the plateau rim east of North lake at the service road intersection a few rods north from the former Otis Summit station (see Ramsay 1859, p. 334-38). Here three directions of striae are superposed (figure 75). The oldest set, preserved only in favorable hollows on the west lee, trends south-southwest parallel with the mountain front and the Hudson valley. This set was made at ice-maximum. A few deeply cut but rather poorly preserved lines run west-southwest, made when the thinning ice was split around Pine Orchard (South) mountain. The latest and most perfect set comes up over the mountain front (as on Rich's map) and heads north of west, straight for the lake, marking the flow of the small ice tongue that gouged out the lake basins and reached on west towards Tannersville. This set was also well seen at North Lake park in the "sidewalk" leading from the bathhouses east up to the "stadium."

Glacial erratics (transported boulders) are widespread in distribution on both quadrangles. The ice brought us samples of all the rocks that outcrop to the north, even the little bostonyte dikes of Lake Champlain. Enduring Potsdam quartzite, various Adirondack granites, syenites, anorthosite and gabbro, with also granite-gneisses and

other northern crystallines, are mingled with rocks of nearer source, from Saratoga, Mohawk valley and Helderbergs, but also chlorite-quartz vein masses from the Green mountains of Vermont.

The most conspicuous of our glacial boulders are, however, all near at home to their parent ledges. A famous one is of cross-bedded flaggy sandstone and overhangs the puddingstone ledge on South mountain. The Twin rocks on the Old King's road one-eighth of a mile south of route 23-A were Onondaga limestone, resting on Schoharie grit; road building has destroyed one of these. Onondaga limestone has made a disproportionate share of the more noticeable erratics in our area and is distributed east over the outcrops of the other limestones and even to the shore of the Hudson.

But note that not all boulders are glacial ones. The mountain slopes in particular are strewn with talus masses, downfall from the cliffs, of which the Devil's Tombstone is one (of Stony Clove sandstone) placed in its present position and attitude by man. A similar mass in its natural location and similarly on edge is alongside route 23 at the west end of East Windham hamlet (Durham quadrangle). Limestone boulders tumbled down from the Kalk berg catch the traveler's eye north of Alsen on route 9-W.

INDIRECT EFFECTS OF GLACIATION

Glacial obstruction and diversion of drainage was naturally highly effective in a region of such varied relief, particularly in the north-draining Schoharie Kill valley and along the plateau front. The cutting of channels now mostly deserted and the building of gravel deltas now hung high record the story. In the Hudson valley, gravel deltas above Lake Albany level are associated either with present streams or with the temporary glacial ones. Because the melting of the ice plus any forward urge within it tended to keep its surface convex, the easiest escape for the meltwaters was along its margin. Here too the surface drainage meeting the ice would often find outlet. Always, of course, some waters of both kinds made their way into the esker-tunnels under the ice.

In the mountains, however, while the Hudson Valley ice lobe remained strong and spilled into the mountains it forced all waters into lakes held in the Schoharie Kill valley by ice dams to the north and compelled them to escape westward through the central range by whatever lowest pass then was unblocked, into the ice-free valleys of the Esopus or the Delaware. Whether any such waters went early through the more eastern and higher gaps (Pekoy notch at 2850, Mink hollow at 2600 feet) we do not yet know; in any case such

Figure 76 Glacial stream outlet, the Stony clove through the main range of the Catskills (figure 54), four miles south by east from Hunter (route 214). View north-northeast with Hunter mountain (see figure 55) at left, Plateau at right. The lake, converted from a swamp-col by an insignificant earth-dam, is a remnant of the stream channel across the notch which has been blocked by talus and landslides in the background (see figure 53). Photo: November 1936, E. J. Stein.

Figure 77 Bed of glacial Lake Kiskatom, now the Kiskatom flats, looking west of north from Rip Van Winkle trail toward Cairo Roundtop (note faint west dip of Kiskatom red-beds in this outlier of the Catskills and see figure 6) about seven miles by road west from Catskill. Several concentric meander loops of the Kaaters kill (present course just behind camera) indicated by darker streaks, especially the latest and deepest ox-bow channel against the far margin of woods and past big tree on right. Photo: April 1938, W. J. Schoonmaker.

flow must have been transient. The first important westward outlet was the Stony clove (figure 76), with present divide (on landslide and talus stuff) at 2050 feet. But the channel bottom here is just about 2000 feet, as is witnessed by its unrefilled portion occupied by the little artificial lake formerly a swamp-col (figure 53).

The earliest flow through the Stony clove was at a higher level, between the ice and the south wall of the notch. Standing on top of the large kame at the north portal (page 192) and looking across the clove one sees this early channel hung up on the mountainside, on top of a moraine, and baring a cliff. Here the imprisoned water ate its way through along the melting ice edge. Eventually, when the clove became clear of ice it took all the drainage, including melt-waters, from as far east as Haines Falls, southeast as far as Platte Clove, and north beyond Hunter, a volume that must have made a respectable river, with power to deepen its channel rapidly. Moreover, this flow and the enlarging glacial lake (Lake Hunter) that it drained lasted until the next lower pass was opened, namely Westkill deep notch 11 miles west at 1920 feet, present elevation.

It will be understood that the cutting of Stony clove was not wholly the work of this river. Like its parallel companions on the east already mentioned, this notch was initiated by antagonistic brooks eating headward from its opposite ends along the weakened zone of a keystone fault (page 180). But on each of the several ice advances and departures in this region there must have been drainage through it, each time cutting it some deeper, with each time a tendency for it to refill afterwards by infall of rock from the side precipices, as today. It is not logical to ascribe much deepening of a V-shaped valley to ice work; it was done by water.

With no land streams of importance entering Lake Hunter and with the glacial streams entering it far below its water surface, there was little opportunity for the building of deltas into it, but the search for small ones is worth undertaking. Some will be found.

The next lower water body, Lake Westkill, lay only a hundred feet lower and therefore also lacked large deltas. Some puzzling things on the road from Hunter to Beach's corners lie near enough to the unrefilled channel elevation (below 1900 feet) to deserve more study, and the delta contoured at 1870 feet between the two brooks out of Hunter notch, mapped by Rich, may belong to this lake if the contours are too low. But especially we have the gravelly deltas of Mossy brook on the Hunter Mountain trail at the proper altitude up to 1900 feet, besides some levels that look suspicious in and around Tannersville.

After Westkill came a long-lived lake with outlet through the Grand gorge, 22 miles west-northwest, at about 1560 feet—a fine abandoned river channel threaded by railway and route 30, well worth visiting. Into this lake ran the combined waters of both branches of the Schoharie kill at Hunter village, building the terraces seen on route 23-A just west of that village, as the outlet channel was being cut down.

Rich (1935, p. 100, 85, 81-82) reports glacial lakes (higher than the Grand Gorge lake) in the East Kill valley, a lake delta in the Little Beaver Kill valley and water levels in the west portion of Stony clove.

When the ice deserted the mountain-plateau and began to occupy only the Hudson valley, strong flow of waters must have swept along its western margin, against the mountain front (Fairchild 1919, p. 35). As yet we know very little about this on the higher slopes except the great swampy terrace on which a trail runs high on the east face of South mountain, with some other water-swept terraces at intervals all along the Wall of Manitou.

Lower channels are more conspicuous, out across the piedmont, wherever not subsequently buried by the alluvial fans of the mountain streams (see page 18). The long southward flow of the Platte kill tributaries from Palenville, of Black brook and Stony brook farther north, is indicative of the controlling effect of these temporary channels upon modern drainage. Where Stony brook crosses route 23-A its course to south, rimmed by a kame-moraine on the east, shows a nice channel-form.

On the whole, however, the ice edge, sloping south, was veering off diagonally across these ledges, rounding around to its tip in midvalley. Hence the opening of diagonal passageways by the escaping waters, such as that of the Platte kill at Fish Creek, of the (eastern) Beaver kill above Unionville and especially of the Kaaters kill from Kiskatom flats to Asbury, which is a distinctly postglacial gorge above and below High Falls (figures 43, 44). With the occupation of the High Falls channel by the Kaaters kill is connected the episode of glacial Lake Durham (on the Coxsackie and Durham quadrangles) discharging behind Cairo Roundtop through the Kiskatom creek into glacial Lake Kiskatom (figure 77), where now are the Kiskatom flats, (Chadwick 1910*a*, p. 27). Temporary earlier employment by the Kaaters kill of another such diagonal escape through the Hooge berg is indicated east and southeast of Saxton via the Mine Kill pass, with a little plunge-basin pond under the 300-foot contour on the far lip, followed perhaps by brief flow through the capacious channel of Rocky brook.

Fairchild (1919, p. 35 and plate 13) has called attention to the ice-margin rivers along the east front of the Hooge berg. One such channel (Chadwick 1910*a*, *p.* 27) is easily seen from the road under the east face of Vedder's hill at Shetland farm, between a rock terrace and the hillside and containing a pond. Part of the process of individualizing the hard-beds terrace under the Hooge berg has been done by such confined waters, especially in the east base of Mounts Airy and Marion, but these channels are subject to obscuration by alluvial fans of hillside brooks, as has happened a mile northeast of High Falls on the road to Quatawichnaach. Nearer High Falls on the same road is the remarkable channel pictured by Fairchild (1919, plate 13), a unique by-pass that isolates a mass of the Mount Marion formation in a manner difficult of explanation. This broad, deep and typical abandoned channel of a glacial river, worth seeing, had southward flow, but the present tiny brook in it has been reversed to northward outlet either because that had the advantage of steeper drop and softer materials or because of temporary northward tilt during uplift (see pages 214, 218).

Not many of these temporary rivers on the piedmont and Hooge berg could build deltas, though they left some scattering gravel deposits such as the one dug for road metal on the improved road two and one-half miles due south of Palenville. But when the larger streams got down to impounded or open waters they made characteristic deltas (Fairchild 1919, p. 35). In our area all these are on the Catskill quadrangle, beginning with the delta of the glacial Kiskatom creek into Lake Kiskatom at Lawrenceville (since converted by the creek into an alluvial fan) blockading the Vly (swamp) on north. Then comes the 230-foot delta of the Kaaters kill southeast of High Falls, which is strictly confined to the alcove, then the 220-foot one of the Beaver kill at Veteran, which is equally so restricted, and the 210-foot one of the Platte kill west of Mt Marion hamlet, which also is held west of the hard-beds cuesta and shows the print of dead ice on its south margin. (These elevations are for delta margins and are lower than Fairchild's figures for delta heads. Fairchild reports also a 220-foot delta at Ruby, on Kaaterskill sheet.)

Thus, except at Lawrenceville, each of these was ice-confined on its east side. Yet each in turn, from south to north, marks the locus of final escape of all the waters (both land and ice-margin drainage), debouching between the rock wall and the ice lobe into an angle of the northwardly expanding level of Lake Albany. Each, then, is a dependable index of the initial height to which the Lake Albany waters rose at that spot. For, if they were built in tiny local im-

pondments higher than Lake Albany, where are the outlet channels leading on down from these and where are the final deltas required by such a postulate? The ice front declined too fast, veered too much away from the hills, corroded too readily, to have maintained such lakelets in these alcoves while the deltas were built. Beaches (page 202) confirm these heights.

That there then comes a drop of two contours from these deltas to the unconfined deposits in each case is attributable to three factors: subsequent compaction of the (later) water-logged deposits in the deeper and open Bakoven valley, natural lowering of the water level when deprived of the gravitational attraction of the ice, elastic rebound of the land when relieved of its ice burden (preceding isostatic readjustment); therefore it can not be used as an argument against their construction in a true lake. Gravel deltas do not compact noticeably when the receiving water body is drawn down, but the clays, which underlie all the deposits in the deeper basins, do so compact to a marked degree, proportional to their primal thickness, for they weigh two and a half times as much out of water as under it. To all our clay deposits we must add something of height in order to visualize their appearance and their influence on subsequent events when the waters began to lower and to expose them to the air.

The effect of the ice on land altitude should not pass unmentioned. Depression of our northern lands, with reelevation since ice-melting, is proved beyond dispute by the "raised beaches" along the open seacoast, reaching as high as 290 feet above present sea level on Mt Desert island, Maine,—wave-washed clean (nonglacial) gravels spread out in characteristic level-topped series, with salt-water mussels and clams of living species in the under-clays. In northern New York and Vermont abundant marine shells, barnacles, even a whale skeleton have been found up to still higher altitudes, the beaches going up to 523 feet above sea. These are postglacial features resting upon the glacial stuffs.

It is pretty generally conceded that the depression of the land during glaciation was due directly to the weight of the ice, a mile or more thick over Catskill and Saugerties since it overtopped Slide mountain, 4204 feet, (Chadwick 1928, since confirmed as late Wisconsin by Leverett and Antevs). Inevitably, therefore, our region was tilted down to the north, in comparison with today, and had this attitude when the ice was deserting it. Thus Lake Albany shore lines, still more those of the mountain glacial lakes, will now be found tilted southward. For the Lake Albany initial heights we have a southward slope of (roughly) 40 feet in 18 miles, from Sandy plain

(Coxsackie quadrangle; see Chadwick 1910*a,* p. 28) to the Platte Kill delta at Mt Marion, or about two and one-fourth feet per mile.

But while the land has risen, the sea has also risen by return of water from the melting of the great ice-caps; consequently our Hudson is a drowned river, an estuary with tidal fluctuations of three or four feet.

Land uplift has trenched the streams down into their own deposits, here and there in new courses upon rock where they have cut postglacial gorges. The Jansen kill flows far below its Lake Albany plains, the Esopus halves its delta and affords two fine waterpowers, one at Glenerie, the other at Saugerties; below High Falls, the Kaaters kill meanders (figures 73, 74) in the clays of the Bakoven valley for six miles until it breaks through the Kalk berg. The Cats kill has divided its own delta, as already noticed (page 198). In this process, which was necessarily as slow as land uplift, slower whenever the stream encountered a rock barrier, it left some interesting mementos. Between West Bridge street (routes 23-A, 385) and Broome street in West Catskill is an old stream meander (Chadwick 1910*a,* p. 28), 25 feet below the original surface of the delta plain, with a beautiful smooth curve (poorly contoured on the map) that formerly carried around in a complete semicircle where now route 9-W has destroyed it by grading, and even as far as Division street. A rock nose on the east end held this meander "frozen" there until its upper loop closed in and cut it off. Since then, as the creek channel deepened, small brooks have gnawed headwaters into both horns of the oxbow, even begun gullying between and accentuating the concurving lines of flow in the bed of the ancient channel, behind the "diner."

Another abandoned meander of the Kaaters kill at the same altitude lies south of the Cauterskill natural dam and bridge, in the mouth of the Fuyk valley, as is shown by the contours, but can not be seen well from the highway. The accordance in height of these two oxbows, with the presence between of cut-terraces at about the same elevation north and northwest of the West Shore station and across the creek on "Jefferson hill," suggests that they belong to one episode of prolonged stillstand possibly connected with the encountering of the rock barrier at the Hopenose (or Hoponose) through which the Cats kill now emerges to the Hudson, (figure 62).

The beautiful meander sweeps of the Esopus at Saugerties are down too near present (artificial) level to be easily discriminated for dating except a small remnant northeast of Oak Ledges and close to Main street, which is contoured above 80 feet elevation. This creek met with no obstruction at Saugerties until it reached its sill

on the Normanskill grits at the 9-W bridge, at not much over 50 feet present altitude (the millpond is 47 feet). But farther up, the abandoned meanders of the Esopus and the Platte kill between Glenerie falls and the Old King's road have determined the sinuous course of that road south from Mt Marion church (where the clay is possibly cored and upheld by esker) and are in contrast to the present straightness of these streams, especially the Esopus, though not much above present water.

The effect of land tilt on stream courses is also to be considered, along with that of morainal blockade, preglacial channels, available passes and another factor of a speculative nature that we may discuss under the title "wave of uplift" though some prefer to think of it as the pursuing "peripheral bulge."

If the land rose like the tilting of a rigid plane, the effect of such tilting should have been to discourage northward-flowing streams, encourage south-flowing ones, produce southward reversals rather than northward ones. Why then our north-flowing Jansen kill, Esopus and Kaaters kill? Some other factor must have controlled in the case of these and numerous similar streams throughout the Hudson valley.

Most of these north courses are in the clayplains, namely under Lake Albany level, increasing the difficulty of the problem. On plains originally horizontal, when uptilted from the north, water should have run southward and so continued to run. This assumes that the clayplains were completed up to water level everywhere. In the slow settling out of the suspended glacial rock-flour to make these clays, they took at first the surface configuration of the floor on which they rest, and only gradually lost that figure as their thickness increased faster in the deeper spots. It was only on building up to lake level, or to "wave base" in it, that they developed a nearly horizontal top, doubtless shoaling northwards toward the ice, their source, and thus further favoring southward drainage on uplift.

But there are two other things entering in to modify this, besides the failure of the clay deposits ever to attain full height over much of their extent. One of these modifying elements is the contributions made by land streams, which continued after the ice itself had ceased to play an important role locally. For example, the clayplain in the Bakoven valley which, where the Kaaters kill leaves it, is under 160 feet elevation, is encroached upon thence northward by a diverticulum of the Cats Kill delta rising to nearly 200 feet altitude (figure 73) at the north edge of the map, as does the main delta mass over east at Austin's. Evidently this is not a plain built behind beaver dams

but is the natural slope of a delta surface. The Lake Albany plain of the Jansen kill declines northward, as already noted (page 198), and in its final shaping is plainly the work of the creek, assisted possibly by beavers in its upstream part but dependent fundamentally on discharge into deep open waters for its base-level. Stony creek, the Sauger's kill and the (eastern) Saw kill likewise topped off and graded their plains, as did the Esopus its big delta at Saugerties. The only clays to which no land-stream contributions seem to have been superadded are in such intermediate spots as Alsen and Cementon, where they could later have had no influence on the courses of major creeks. That even in such places the clays rise to elevations of 80 to 100 feet (in the Fuyk, figure 17, to over 140 feet) shows that the land-streams did not have a major share in producing the clay portions of the Lake Albany deposits elsewhere but chiefly built coarser stuffs upon them to top them off. Nevertheless it was just this final topping that shaped the direction of subsequent stream flow over them.

The second modifying factor is compaction (page 212). Compaction being greatest where depth of clay-fill was greatest, would lower the surface most over buried valleys, thus tend to draw the streams back into them. Many times, however, it failed to do so because its effects were too tardy. The Esopus got started around the north edge of its delta at Oak Ledges before the uplift had raised the delta enough to have much compaction follow. When this compaction came, all it could do was to initiate a small gully turning surface drainage from the delta back into the Esopus above the Ledges and a companion gully leading east to the Hudson. The Cats kill was already so strongly sunk into its present course, which has let it down on one rock barrier after another, that only the small Mineral Spring brook and Burget's creek (plus companion gullies on north) could take advantage of the settling by compaction in the preglacial extensions of the Hans Vosen Kill and Corlaer's Kill valleys. The Cats kill was not even able to evade the rock rib of the Hopenose at its mouth, where little DuBois's creek (Uylen Spiegel kill) goes around it unobstructed on the south.

Nevertheless, compaction helped to hold the Beaver kill (figure 2) to its course in the Bakoven valley, whereas it might just as easily otherwise have wandered off east through the archipelago of ridges, as Lost brook has. In fact, rigid plane uplift should have compelled the Beaver kill to do this and to take the Kaaters kill with it. Yet in the face of land-tilting the Beaver-Kaaters Kill drainage found its way northward for 10 miles to the exceptionally favorable low passage through the Kalk berg, then moraine-filled. Then why not also the

Esopus, which has chosen the much higher gap at Glenerie falls, but whose northward flow in this Bakoven valley is mostly off our map, on the Rosendale quadrangle? Will compaction explain all this?

A longitudinal profile of the clayplain in this Bakoven valley for the length of the Catskill quadrangle shows that even today after tilting it declines slowly northward (not southward) from 180 feet elevation where the Old King's road crosses it at Mt Marion to about 150 elevation where the Kaaters kill leaves it, just short of the obstructing Cats Kill delta above mentioned. The evidence as to the buried rock valley does not suggest greater width (presumptive greater depth) at the north than at the south end of this stretch. The narrowest point between the rock walls is nearer the lower end, namely just north of the county line, below the mill and bridge north of Asbury, where there is, moreover, a further constriction by esker gravels on east and delta gravels on west. Yet the Kaaters kill turns abruptly north through this narrows instead of continuing south in the broader unobstructed part where the Beaver kill now meanders lazily. Incidentally, there is no mark anywhere that the Kaaters kill ever had and abandoned such an escape across the clays and out to east in that southward direction, nor at the other favorable spot at Percy Holmes's two and one-half miles north of Asbury to the Sauger's kill.

Evidently we must seek something other than compaction to explain this steady and unexpected northward grading of the clayplain from Mt Marion to west of Cauterskill. Indeed, because of stream trenching down its middle, the plain gradient could be plotted only on the marginal remnants, where compaction was least effective. This gradient leads up suggestively to the Esopus and Platte kill as the source of the detritus that veneered and gave northward slope to this plain. That raises two difficulties. First is the apparent failure of the Kaaters kill to keep its own constructional work up to match that of these streams. Second is the question why the Esopus or the Platte kill if once established on a surface that even now declines northward should have deserted so favorable a location (improved by compaction as that went on) and, neglecting the more capacious pass where Lost brook escapes, have turned east over the hard and high barrier of Glenerie falls.

The answer to the first may be that the Kaaters kill was leaving its burden farther up, to fill the bed of Lake Kiskatom (figure 77), and had only the short stretch of the High Falls channel (then shallow) to clean out (figure 44). Still we have no proof that Lake Kiskatom had not already been fully upgraded as the receptacle of glacial rivers

from around both sides of Cairo Roundtop. Such an answer is therefore only a surmise.

The second difficulty might be answered by invoking either stream capture or original alternative discharge such as the Cats kill had at the north end of our map; but with this difference, that while the Cats kill distinctly favored its present eastward course and built its larger delta mass there as compared with the short stretch in the Bakoven valley, the delta of the Esopus at Saugerties, its present course, is not large as compared to the long filling in the Bakoven valley that would thus be attributed to it. To make that the work of the Platte kill alone (with later capture of the Platte kill by the Esopus) might be attractive when one notes that northward drainage at Mt Marion starts on the plain right in line with the debouchure of the Platte kill from the Hooge berg, were it not that a rock rib 20 feet higher lies athwart this proposed connection. There seems to be no evidence left of any flow of the Platte kill northeastward around this rock barrier, nor indeed that either it or the Esopus crossed the inconspicuous divide at the route intersection in Mt Marion hamlet. So again we have only a surmise.

Recalling that initial Lake Albany deposits gave us (page 212) a measure of two and one-fourth feet per mile for the southward tilting since they were formed, equivalent to about 30 feet in the 13 miles that we are considering, and that the clayplain now slopes 30 feet in the opposite direction, we seem to see the sum of these or 60 feet as the initial north slope of this stretch of plain in Lake Albany times, or four and one-half feet per mile. The present north slope of the Jansen Kill high-level or Lake Albany plain is 70 feet in six miles, more than 11 feet per mile without adding for tilt. The comparatively low gradient of the Bakoven plain and the comparative absence of coarser alluvium upon it suggest that it was made under rather than out of water and allow us more readily to fall back upon the Esopus as its parent.

Nevertheless it would be easier to understand this history of northward flow in terms of a reversed or northward tilting of the land at a crucial time in its emergence. The streams of our area are not exceptional in this anomaly. From Halfway creek at the north end of the broad Hudson valley to the Rondout creek and Wall kill at its south, this so-termed pine-tree drainage prevails. It was the case also with the postglacial discharge of the Iromohawk river, running far north to Gansevoort (Chadwick 1928*a*, p. 910, figure 5). Does the "wave of uplift" give the solution?

Under this hypothesis of the wave of uplift (Fairchild 1919, p. 16-

17, 21, 28, 29; anticipated by Woodworth 1905, p. 224-26, 229-34; Upham 1892, p. 335), the land rose not as a rigid plane but in a wave-like progression from south to north as the ice front melted back and its load was removed. Thus Saugerties would be gaining something of its present altitude while Catskill lay still submerged. This would mean a temporary increase in northward gradients, sufficient perhaps to enable the streams to attain and later to maintain their anomalous northing. Meantime, during this period of northward flow, they might upgrade the clayplain in the Bakoven valley to such a gradient as would exceed the amount of subsequent reversal of tilt when the wave passed on north.

The hypothesis of the pursuing peripheral bulge involves even more movement. Starting with the evidence (mathematical and physiographic) that a bulge of the earth's crust surrounded the areas depressed by the weight of continental ice sheets (compare Cook 1924, p. 160), and that this bulge must form while the sheets were smaller and be driven ahead of them in increasing bulk as the ice augmented, a reverse process is postulated during ice-waning, the bulge contracting in size and radius with the contracting ice area but naturally lagging at some distance from the ice front. Either view will explain Lake Albany, not as a single continuous water body from Staatsburg to Fort Edward, (Woodworth 1905, p. 175, 177, 241-42, pl. 27), but as one that continuously migrated northward between the ice and the "wave" or the "bulge" and thus never lost its individuality nor its right to a single name.

The bulge hypothesis implies an overtilting southward as the bulge is passing and a distinct fall-back or northward retilting after it has passed. The implications and criteria of such a movement in our Hudson valley have never been faced nor the field evidence for or against it worked out. Whether the northward gradient of the Bakoven plain may best be explained by such a reversal remains an open problem for someone to solve. Northward drainage today in the channel northeast of High Falls (page 211) may have originated while the wave or bulge was passing. One might look upon the swamps of the Great Vly and north of Kiskatom flats as due to such retilting were it not possible to explain each of them as unfilled alcoves blockaded by the alluviation of the Sauger's kill and Kiskatom creek respectively. But the remarkable northward decline (noted by Woodworth 1905, p. 122 and plate 7) of the Livingston pitted plain from 280 feet at Twin lakes to 250 feet at Bell pond, 30 feet in eight miles, can hardly be ascribed, in this ice-margin deposit, to either wave of uplift or peripheral bulge.

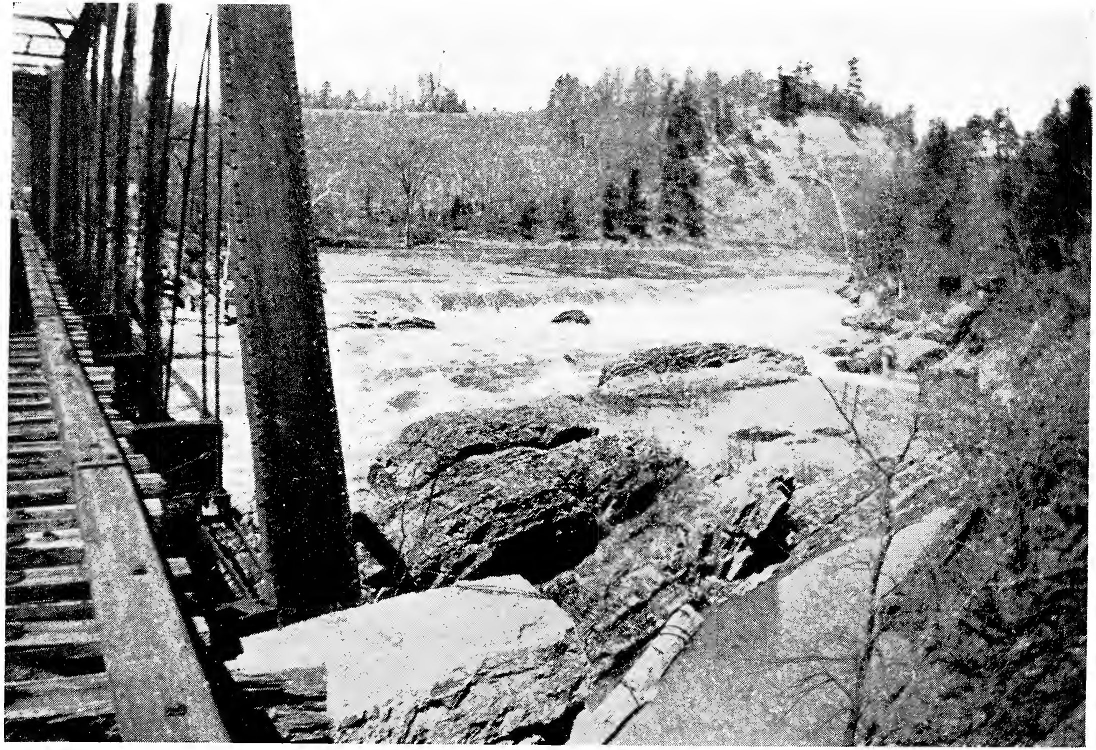

Figure 78 Postglacial gorge of the Cats kill showing structural control, at upper end of Austin's glen (above "Third Bridge" of former Catskill Mountain railway) not far below Leeds. (North edge of Catskill quadrangle passes through the far cliff of Esopus shale.) Stream on strike of Glenerie vale to the natural dam of Glenerie-Alsen-Becraft beds and again on strike of Catskill shaly beds (foreground) below the fall. Looking north-northwest. Photo: April 1923, Clayton H. Brown.

Our preglacial Cats kill may have received the upper Kaaters kill on the Coxsackie quadrangle by way of Kiskatom flats, and may itself have turned south down the Bakoven valley to cross the Kalk berg where the Kaaters kill now crosses. Only small moraines now block these routes, forcing the Cats kill to fall into the tortuous post-glacial gorge of Austin's glen (figure 78) and the Kaaters kill to drop over High falls (figure 43). The Esopus may have crossed the Kalk berg at the Indian caves, with a long tributary from Asbury in the Bakoven valley. But these are open problems.

The interesting subject of glacial potholes has been passed over. Formed by cataracts in ice crevasses, such potholes may occur in spots where no land drainage could have made them, such as the one described by Osborn (1900) in the shales of Church's hill, opposite Catskill, first reported by Hubbard (1889).

GEOLOGICAL HISTORY

THE LOST INTERVAL

Depositing of the early Paleozoic beds, Cambrian and Ordovician, was brought to a close by a spasm of mountain-making—the "Taconic orogeny" or "Green Mountain revolution" of writers. Beginning as far back as Lorraine time, the premonitory restlessness of this great upheaval had become evident in more rapid rising of the old mountains on the east in New England that were supplying the sediments to the sea waters lying over New York. Already perhaps, certainly by Queenston time, eastern New York had been raised out of water and was being re-eroded by the rivers crossing it from New England westward. The final cataclysm was doubtless well under way during Queenston deposition (Richmondian).

Folding of the Cambrian and Ordovician strata, thousands of feet thick, was progressing on the New England border. The intensity of the compressive force, on these comparatively weak and yielding beds, eventually ruptured them across into slice after slice, driven over (telescoped) one upon another, thus thrusting the folded rocks from the edge of New England into our region. One need go no farther afield than the Helderberg scarp near New Salem on the north, or to Eddyville southward, below Kingston, in the opposite direction, to see comparatively undisturbed and later Ordovician beds that were resident in our area before these older folded ones were jammed over upon them. In fact, it is likely that the western edge of the overthrust sheet is buried but a very short distance behind the concealing cover of the Kalk Berg escarpment and that wells drilled west of this line will encounter the Snake Hill beds immediately beneath the Rondout strata.

But this means a prodigious amount of erosion of the overthrust Ordovician deposits, their vertical thickness so much increased by the folding and telescoping, in order to get down to the earlier portion (Normanskill) that had become exposed before the Silurian sea returned. We have, thus, a story of great mountain-making (folding and thrusting) closing the Ordovician and of prolonged erosion during the early and middle Silurian of the mountains thus formed until they were reduced to a nearly featureless surface by the opening of Rondout time.[1] The record of this is the great hiatus (figures 58, 13) between early Ordovician and late Silurian strata that lie in unconformable erosional contact throughout our area. See pages 141 to 150 for the field facts.

Absence of a soil band at the contact, with marine Silurian shells lying directly in the fresh clean-swept little hollows on the top of the bevelled Normanskill, shows that the final leveling of the old land was done by the waves of the returning sea, itself. Detrital material from the Normanskill graywacke grits was reworked by the waves and came to rest in some places as a basal bed of the Rondout (see pages 146-47). Over a considerable stretch, a sand-bar was built, inclosing lagoons of quieter water where only the finest waterlime muds were laid down, devoid of the open-sea shells, corals and bryozoans of the limestones outside the bar.

Supplementary Note

[1] There is ample evidence that the Ordovician rocks were intricately folded and upedged before erosion took place. There is also convincing evidence that the surface they presented to the reception of the Silurian deposits was a very smooth one. No hills in this surface are known. The overlap of the Rondout upon it is broad and gentle, differing only 40 feet in maximum and minimum thicknesses of those beds across the quadrangle. The under surface of the Rondout at any given exposure is not known to exhibit undulations or variations of more than two inches at most.

Such a smooth surface cut across plicated strata of hardnesses varying from weak shale to resistant grit beds may be looked upon as the product either of prolonged atmospheric erosion—a peneplain—or of wave-planation. A noticeable feature of the sandstone beds of the Normanskill just under the (present or past) contact with the Rondout is a limonitic staining similar in color to that of the overlying buff waterlimes of the Rondout, so that one may be mistaken at first glance for the other. This is not a usual weathering color of the Normanskill beds elsewhere; indeed, a few feet away from the contact that may be dun-colored as usual. Whether such discoloration should be looked upon as derived from the waterlime and thus essentially modern or as of pre-Silurian age and the source of the ferrous stain in the Rondout may be debatable. The former seems a more likely explanation, in which case we are left without any indications of weathering at the contact. Moreover, such perfect peneplanation is difficult to conceive.

This compels us to face the evidence for wave-planation by the advancing Silurian sea. The products of such planation should be in part gravels and sands. Of such gravels there are none, nor have I learned of any pebbles of Normanskill imbedded in the base of the Rondout. If there are any, to be wave-made they should have the "peppermint-drop" rounded-flat form characteristic of beach shingle. Basal sands, such as the Binnewater sandstone

that comes into the section farther south, are restricted here to a limited belt, outside of which the soft buff waterlime or even a purer limestone reposes directly on the Ordovician. Where the basal bed is a sand, it usually differs from the quartzitic sand of the sandbar above it in being a reworked Normanskill arkose, to which lime (organic) particles have been added, and does not suggest heavy or considerable wave-work. Neither does the structure of the Fuyk sandstone, which, with a width of over half a mile, is only 20 feet high and has a smooth and parallel stratification (compare figure 15) not at all cross-bedded. The basal bed behind this bar, around Catskill, has of course no bearing on the problem; it is a lime mud half filled with quartz grains that appear to have been blown into it from the Fuyk bar by the wind. But into the waterlime above it no sand was blown from either sea or land.

The source of even the sand that we have may not have been wave erosion, for rivers from the land could carry and contribute it ready for the waves to spread out. Unless pebbles are found, which rivers would not have transported across the subdued surface, we are left, therefore, equally without evidence of wave-planing. That the Normanskill beds were then as hard as today is implied in the great compression they had undergone, at such depths underground that they barely escaped the metamorphism that befell the Ordovician and Cambrian rocks not far east of the Hudson. It is proved directly by the rounded aspect of the harder layers where they project on the ancient surface, looking "sandpapered" as they doubtless were by the waves before burial.

Certainly these waves could not have battered very high irregularities of the surface without entombing some of the debris of them. Thus it seems that wave work merely gave the final touch to a process of leveling already far advanced over this region, and this after a long period of stillstand, a time during which no detrital deposits of any magnitude were forming to the west but only the very fine lagoonal or calcareous muds of the Vernon, Syracuse, Camillus and Bertie deposits (and their equivalents, Bloomsburg, Wills Creek and Bossardville beds at the south) closing with the pure Cobleskill limestone. It is only the earlier beds, the Medina, eastern Clinton and Shawangunk, that mark the initial vigorous erosion of the newly uplifted Ordovician Taconic mountains. The higher Silurian strata show clearer and clearer seas of the old-age stage in the erosion cycle on the bordering lands.

According to published accounts, the Rondout sea failed to reach Becraft's mountain, the top surface of the Ordovician is more uneven, in shales (Schuchert and Longwell 1932, figure 5 and page 318), and the Manlius is conglomeratic where it fits into the hollows. This looks like more hasty submergence in the Manlius sea, when that arrived.

TIME OF OPEN SEAS

When thus reestablished over the region the sea remained for a long time, with only few and minor interruptions. These came (see pages 150 to 154) at the close of the Cayugan, the close of the Helderbergian, possibly within the Oriskanian, and at the close of the Ulsterian. Before taking these up more fully it is well to emphasize that orderly deposition of conformable strata was not seriously interfered with by them and that on the whole the region remained one chiefly of limestone-making in clear waters of the inland sea until the great "Catskill delta" of the later Paleozoic began to encroach upon it.

There were times, to be sure, of inroad of terrigenous material from the eastern mountains, making the limestones impure with shale, as during New Scotland time, or even temporarily overwhelming lime-secreting life with inorganic silts, as during the Esopus. Here is record of geographic and climatic changes on the neighboring

lands to east and south, or in the sea floor itself, producing those differences that mark off each formation from its predecessor, often sharply. Rivers and rainfall shifted, seas shoaled or deepened, new congeries of sea life found the habitat to their liking—and a new formation began to be deposited. To rehearse all these little variations seriatim would be wearisome. They are implicit in the descriptions of the formations themselves (pages 44 to 99) and to those descriptions the reader may turn.

Of the interruptions mentioned, that at the close of the Helderbergian is the most striking. Although the contact of the Glenerie on the Alsen or the Port Ewen is a smooth one at any given exposure throughout our area, yet there is often, perhaps always, a zone of phosphatic nodules in the contact seam, usually with a dark blue-gray ("black") shale resting upon it that is suggestive of a soil band. Farther west in New York the equivalent Oriskany sandstone rests upon lower and lower beds, and by filling cracks and caverns in these gives proof that its ocean returned upon a long-weathered land-surface. We can not yet safely assert that the Helderbergian strata here in the east shared even briefly in this exposure to the air before Oriskany time. The time break is here much shorter than there. Nevertheless, there is missing already at Glasco over a hundred feet of Port Ewen beds that at Kingston, only six miles south, intervene between the Alsen and the Glenerie. Either these layers failed to be deposited hereabouts, or they have been subsequently eroded away. The presence of the phosphatic nodules and the concentration of worn fossils at the contact argue for re-erosion and hint at uplift out of the sea as the reason for it. But wave ablation may have sufficed.

Less conspicuous, but more surely subaërial, is the erosion of the top of the Manlius preceding Coeymans time. Here we have a bonded contact between rather like rocks, both of them clean limestones though differing in coarseness of grain. At almost every exposure a careful examination shows a foot or two of disturbed and rounded-edged slabs of the Manlius interfiltrated with the Coeymans lime-sand and fossil fragments. Once, in the Helder berg, Mr Hartnagel and I found a quartz pebble as large as one's thumbnail, in this contact zone. These conditions bespeak exposure to weathering, followed by wave work on a sea platform during resubmergence. All of upper and middle Manlius is missing. This break too, however, was brief.

The failure of the highly fossiliferous upper Glenerie beds to reach north of Malden seems to let the Esopus down upon the cherty or "bony" beds of the lower Glenerie, suggesting a break within the Oriskanian, though this may be illusory and due to change of facies

northward. The last marked break came at the close of the Onondaga limestone deposition, allowing the top surface of that limestone to become corroded (pitted by solution) and some of its fossils to accumulate loose in these pits, with brownish material looking phosphatic, before the black Bakoven muds came to rest upon this surface. This again looks like, though it may not be, an effect of exposure to the atmosphere.

But with this Bakoven shale, limestone-making here ceased, and there began the upbuilding of the great "Catskill delta."

THE GREAT DEVONIAN DELTA

From the close of Onondaga time, with its widespread making of purest limestone (coral reefs), onward, an entirely new episode began in our sedimentary history. Instead of the thin limestones of the open seas, heavy masses of land-wash came piling in upon us from newly rising mountain lands at east and south of our region. That such and not Canada is the source-direction for the sediments of the later Paleozoic rocks in New York and Pennsylvania, stretching even far into Ohio, is shown by the manner in which they thicken and coarsen to the southeast, transforming also in that direction into land-made red-beds with forest trees.

These sediments are distinctly unlike any that came before them, in our area. From the equally thick delta sediments of the Ordovician which they most resemble they differ in ways immediately evident to the accustomed eye. What these differences mean as to the conditions of origin is at present largely a closed book. The precise study of sedimentary rocks, particularly with the petrographic microscope, is very young, its devotees few. We know that "sandstones" and "shales" are as diverse among themselves as some of them are from limestones. And there, for now, the story rests.

The zoning of these delta sediments into five different facies, each in turn farther away from the mountain sources, has been described on page 140. After the regular fashion, black shale (Bakoven) of the most seaward ("Genesee" or in this case "Marcellus") facies zone was the first to reach us, constituting essentially the "bottomset" beds of the approaching delta. Then followed barren sandstone (really siltite) of the next zone landward ("Portage" facies), and the delta proper was upon us. The fossiliferous sands and shales of the shallower warmer waters ("Chemung" facies), coming next above as the sea shoaled, comprise locally the Mount Marion formation, closing with the "storm-rollers" that may mark the surf-line on the emerging delta surface.

This emergence unquestionably came about chiefly from the up-

building of the sediments themselves, as today the Mississippi is ever raising its flood plain and pushing its mouth farther into the Gulf. Yet we face a puzzling fact, not merely in the immediate region but as far as these delta sediments extend—to central Ohio and to northern Alabama. In any given formation, the kind of sediment, the kinds of fossils, and therefore the approximate depth of water, remain the same through perhaps hundreds of feet of strata, as in the 600 feet of our middle and upper Mount Marion. Either subsidence of the ocean floor or steady rising of the sea level, equal to the thickness of these beds, must have obtained during their depositing. The delicate timing of the one to the other is partially explained by the power of the waves to take and redistribute into appropriate depths of water (facies zones) the materials supplied to them by the rivers.

Nevertheless, the arriving land-wash came in such quantity as eventually to force the shore line westward beyond Kiskatom (and then beyond Palenville), so that beds of the fourth (the "Catskill") facies commenced to be laid down, upon land, upon perhaps such a land as the western Colorado has built in the vicinity of the Salton sea and the Imperial valley of southern California, but less confined. This change, so conspicuous to the eye as reds suddenly appear among the rocks and so striking paleontologically as marine fossils give place to land-plants, river-clams and river-fishes, is thus seen to be, after all, not nearly so significant genetically as that at the base of the Bakoven shale. Here are the same sands and the same muds from the same hills and on their way to the same sea, but how different they look before the waves and the life of that sea have had their way with them!

What happened in the closing stage of the Kiskatom red-beds, resulting in the deposition of the three Kaaterskill sandstones upon such irregular surfaces of their interbedded shales (figure 49), is not clear except that the strandline had shifted farther afield, the delta surface built higher above sea level, become more subject to alternate scour and fill as the river channels swung this way and that across it. A slight westward tilting and re-erosion (or at least nondeposition on the steepened gradient of the surface) is suggested as occurring at the close of the Kaaterskill (close of Middle Devonian; see page 136). The Genesee (Sherburne) beds seem to wedge out towards us. The next conspicuous deposit in our area is the great pudding-stone conglomerate (figure 51).

Pebbles in this conglomerate (especially at the Boulder) are largest at the base, some as large as one's head, at times almost devoid of binding matrix between them, and not always as perfectly rounded as might be expected of far-transported cobbles if carried solely

by rivers. No one has yet searched them diligently for the marks characteristic of glacial cobbles, the faceted and striated surfaces, but it will not be surprising if such are found. For the conglomerate is so widespread, of such varied materials, so lacking in bedding-planes, so far removed from any possible source in the old New England Alps, that one turns naturally to the thought of glacial kame-gravels, of an ice sheet moving down over the plain from those eastern mountains in early Upper Devonian time. This puddingstone has nothing to do with the sea; could rivers have brought such coarse stuff so far? Red-beds and glaciation go together elsewhere in the Paleozoic.

All through the overlying stuffs small pebbles are scattered, mostly of pure quartz, as sometimes also locally in the beds below. There is an interesting interlude, that of the Stony Clove flagstones, in which the red color temporarily ceased altogether (largely because no true shale was deposited), and above that level the reds are increasingly scarcer while the sands grow coarser, more pebbly and whiter. These are the deposits of the last (or "Pocono") facies zone, best seen in our area in the summit of Hunter mountain but far better developed in the later Katsberg strata of the Witten berg near Slide mountain (Phoenicia quadrangle). These may be looked upon as the "topset" beds of the delta and it is perhaps unlikely that any considerable thickness of other beds was ever laid down upon them, wherever they occur in this facies.

The delta grew on far westward, and through a much longer span of time than is represented by it in our region; but very little if any sediment came to rest on its surface hereabouts during the later Senecan, the Chautauquan and the Bradfordian epochs that ensued. Erosion may even have begun, in a small way, before the great uplift came.

TIME OF THE SECOND FOLDING

It has been quite generally assumed that the second folding of our strata, which plicated the Silurian and Devonian beds of our Kalk berg (up to the Bakoven shale) and gave dip tilt to all the rest of them, took place at the same time as that of the Pennsylvania folds, namely the Appalachian "revolution" or orogeny at the close of the Paleozoic. A dissenting voice is that of Doctor Clarke (1915*b*, p. 156-57), who puts the folding before the commencement of the red rocks, if we read him aright. Because of the tilting of the lower part of these reds (Kiskatom beds) along with the underlying rocks of the Hooge berg, Clarke's intent may be understood as applying to the beds from the Twilight Park puddingstone up and in this sense has much to commend it. It accords then with the state-wide

break between the Middle and Upper Devonian formations. But there is a larger break at the close of the Devonian, which is the time of climax of the Acadian orogeny to which these earlier movements led up.

Dating of our folding as post-Paleozoic, Appalachian, brings up two snags: one, that the direction of our folds does not agree with that of the Appalachian folds as they come northeast through the Shawangunk mountains to the vicinity of Kingston; the other, that they fail to agree with those also in size. They are miniature crumplings, confined to a narrow belt of less than two miles maximum width on the west of the Hudson, failing west beyond the Bakoven valley and equally failing east over most of Becraft's mountain but with another and narrower such belt on its southeast rim. Two narrow belts, with undisturbed strata between, do not resemble the folds of Pennsylvania. The association of our folds with those has been on geographic contiguity rather than structural connection and because no folding between the Taconic and the Appalachian had been noticed elsewhere in New York.

But in Nova Scotia and New England, between these two times, another great mountain-folding, with metamorphism and igneous outbreaks, fully the equal of either of them was going on during the Devonian and culminating at its close, the Acadian "revolution" or orogeny. Twice already its earlier convulsions had been felt in our area: first at the close of the Helderbergian time of limestone making and initiating the terrigenous deposits of Oriskany-Esopus time; second at the cessation of all limestone making after the Onondaga and the beginning of the huge deltaic deposits of the Hooge berg, Kats berg (Catskills) and westward just described above. The mass of this Devonian delta is enormous, signifying a new very great and continuously progressing uplift of the feeding grounds in New England. The slow folding of our Kalk Berg belt, so slow that the brittle Manlius limestones are sometimes doubled back on a radius of two or three inches without fracture, may have been under way throughout the delta time from the Onondaga onward, as overthrusting before the heaviest load of the delta beds was put upon it, later bending under this load so as to give us our undulated thrust planes and our nested folds.

The diagonal cross-folding in the south half of our quadrangle, already adverted to (page 164), might be taken as indication of two successive movements in slightly different directions. Even if so, neither one of them would be Appalachian in direction or character. The diagonal lines of the south half are the trend lines of the north half and also of the mountain front and of the major jointing. So

it is rather the general trend, in the south half, than the folding that is askew, corresponding there rather to the strike of the Ordovician ridges whereas the folds throughout the Kalk berg are disposed acutely across these.

There comes to our aid the hypothesis put forth on page 180 that our miniature folds in such narrow belts are merely crumplings upon the toe of the rejuvenated Normanskill overthrusts. This would imply that the fault-trace bent at Katsbaan as does the Kalk berg. A shove that was at right angles to its north half would then be oblique to the more southerly portion and should produce just such diagonal crumplings as there found.

Whatever the age of the limestone folding, there is one major element in our structures that belongs to the Appalachian movement and that is the northerly dip on the southeast side of the Catskill Mountain plateau and the gently broadly synclinal structure of the whole mountain mass of which that dip is a part. Our Catskills lie at the northeast tip of this great geosyncline, the synclinal axis passing northeast through its three highest peaks: Slide, 4204; Hunter, 4025; Black Dome, 4005 feet, on respectively the western, central and eastern border ranges.

The net result of all these movements, with at least two periods of folding, was to make the complicated structures we see today, but not immediately to expose them to view. That came later. The notable thing is that in the upheavals attendant upon these two or three mountain-makings no portion of our Paleozoic rocks wholly escaped. The Ordovician strata experienced two compressions, the Silurian and Devonian beds suffered but one, though it was quite enough to render this the most intricate area, geologically, in New York State.

The folds of our region are therefore of two kinds. In the Normanskill beds, twice compressed with an erosion interval in which their first anticlines were decapitated and weakened, the naturally incompetent strata have been mashed into a systemless confusion of "isoclines," folds with the two limbs brought into apparent parallelism of dip (figure 63), as may be seen best in the fresh cut at the west end of the Rip Van Winkle bridge. Only occasionally have beds in this group been stout enough to take on regularity of folding such as at the entrance to Austin's glen (figure 61) on the Cats kill and at Saugerties on the Esopus. The folds of the Silurian and Devonian beds, on the contrary, are of the "competent" type, in which the cores of the folds have not been squeezed out.

The absence of normal faults in an area so close to the major faults of that type in the Mohawk valley is noteworthy. Conditions

that one would think favorable to normal faulting are found in the strongly developed master joints of the flagstone belt and throughout the flat-lying strata of the red-beds; moreover it is a common experience in other regions that compression, folding and thrusting are succeeded by normal faulting. In this respect our region is exceptional, for that closing chapter in the structural readjustments seems to have been omitted. The small normal faults described (Grabau 1903) in Becraft's mountain appear to have been contemporaneous with the shakeup during its ride on the back of the Ordovician overthrust.

THE LONG HISTORY OF EROSION

The erosion that has removed a mile and a half of rocks from over Saugerties, Catskill and Hudson must have had its inception at the moment of any upbuckling of these strata. That such erosion was already under way when the later Devonian beds with their quartz-pebble conglomerates were forming in western New York seems reasonable, helps to explain these deposits far from the mountain sources in New England. The earliest rivers still flowed west.

The major erosional features of the region concern larger areas than that of our maps. The great contrast between the Hudson valley on the one hand and the Catskill mountains on the other (figures 4-6) is a part of the physiography of all eastern North America, for the one is a segment of the great Appalachian valley with its included folded mountain ridges and the other is but the extreme northeast corner of the Allegheny (Cumberland) plateau. The beds of that plateau once extended continuously over the valley, as will be seen when one views their present cut edges in the mountain front (figures 4, 5, 50). But rivers running west could not do this carving of the Hudson valley.

There are many proofs that the courses of our rivers were not originally or formerly as they are now and many theoretic reasons why they could not have been so. In what directions they successively ran and just how they got into their present channels are the subjects of most engaging and divergent views by those who have essayed the solution; (see the titles in the bibliography for Davis, Fairchild, Guyot, Heilprin, Johnson, Mackin, Rich, Ruedemann, and Tarr). Some of these writers believe that our entire region went once more under water, in Cretaceous time, after its surface had been considerably lowered and flattened by erosion, and was covered over by an extension of the Atlantic coastal plain deposits all trace of which has since vanished except the new courses impressed upon the rivers crossing it, such as the Delaware and the Hudson.

For our area we can neglect all that lies outside and consider only

how the Hudson drainage took the place of westward drainage. In whatever manner the Hudson first crept into our quadrangle from the south, whether by the Mamakating (or Wawarsing) valley from Port Jervis or across the Highlands as today, it found here a belt of rocks much weakened by uplift and folding. With its shorter run to the sea, it was able to capture one after another of the headwater rivers flowing across this belt and far westward, thus extending its own valley ever northward. Later, as it sank to the weak Ordovician shales, it made its bed permanently in these, annexed their extension around south of the Adirondacks in the same manner by means of its tributary Mohawk and from the last sent the Schoharie south up into the Catskill plateau to complete its conquest of the area. Now, in the Kaaterskill and Plattekill cloves it is even robbing its own tributary. (See figures 7, 10, 50.)

Systematic stream piracy, as Doctor Ruedemann has said (1932, page 348), thus holds sufficient explanation for the drainage features that concern us locally. But the long process of erosion has other phases. The removal of all this thickness of rock was not accomplished in one continuous episode. It proceeded by stages and pauses, with intervening renewal of uplift. Such stages betray themselves in peneplains, namely in base-levelings of the region whose traces still remain after it was again raised and dissected anew. Our higher peneplains are present in the mountains; a lower and later one, better preserved, is seen in the horizontal skyline of the Kalk Berg and Hooge Berg ridges of upturned rocks (figures 4, 5, 6) as so well viewed from the Catskill Village reservoir near routes 23 and 385, or from Quarry hill. The whole floor of the Hudson valley once stretched unbrokenly across where now these hilltops mark the line. After its further uplift above sea level, the streams etched out the weaker rocks, rain and weather carved the ridges but left long stretches untouched to tell the story. In this interim many changes due to piracy must have occurred, their record now largely obscured by glaciation.

From this more easily observed sample of a peneplain we may go north to East Windham (Durham quadrangle) and look out upon the even skyline of the Helderberg plateau on the north, an older peneplain now raised to a much higher elevation, around 2000 feet, which continues on the north of the Catskills clear around into and across western New York and far southward behind the Allegheny mountains, the Cumberland plateau. Above this peneplain when it was formed, (probably then down near sea level), rose both the higher Catskills and the higher Adirondacks, as spared remnants ("monadnocks") of an older higher land surface. From it, broadly

open valleys (figure 10) reached far up into these mountains, (as those of the Saw kill and Little Beaver kill do from the lower peneplain), are represented still unchanged in the upper sections of both forks of the Schoharie kill on the Kaaterskill quadrangle but are now somewhat deepened again from Tannersville to Hunter and below. The road from Hunter to Windham (route 296) rises over a remnant of the old valley floor on its way to Beach's Corners, and the East Kill valley above East Jewett post office is a part of one. The course of the Schoharie must have been determined before this peneplain was finished, as there are no other such broad outlets.

On this broad peneplain, beyond the Catskills of that time, ran also the early Hudson and the Mohawk, both of them probably much farther away than they are today. Starting with their courses on the weakest rock-belts then exposed for them, certainly the Mohawk and probably the Hudson have migrated down the dip (compare figure 44), towards the Catskills, by sticking to these weak rocks as they slope into the great geosyncline. This explains how the Hudson circumvented the resistant flagstones and conglomerates of the Catskill Devonian delta. It did so by "sapping and mining" from the eastern borderland.

Stepping once more backwards, we have the long sloping lines of the mountain summits (figure 54) both northwest and southeast from the ridge line of the three highest peaks (page 39), as pointed out by Guyot (1880), which may be the lingering record of a peneplain either subsequently bent or originally sloping both ways from a drainage divide. What seems like a considerable remnant of it is the long level crestline of Plateau mountain, which, as viewed from Tannersville, is nearly two miles of straight skyline. If these mountain summits are really on a peneplain, it is the oldest one of which we have existing vestiges.

Including it, three successive uplifts (see Chadwick 1935*f*, figure on page 2056) have left distinct record in our area, three stages of land lowering by erosion since our structural features were completed, the first stage of a wholly unknown amount, the next two of nearly two thousand feet each, with no knowing how many partial ones between, whose marks have been destroyed by those coming after. The last uplift is also of unknown amount, another two thousand feet if the submerged canyon of the Hudson out in the ocean beyond Sandy hook was river cut. Locally, the Hudson had time to excavate its "inner gorge" (page 202) to a depth a hundred feet below present sea level before glaciation stopped it, and its tributary streams to do

a large part of the etching out of their courses that we now see. Undoubtedly the land stood high.

What part that extra height had in bringing the glaciers down upon us, and how often they came and melted away, we do not surely know. Their work, already described, was a very minor episode in the long history of erosion.

ADDENDA (1942)

Wartime conditions and delays arising in the four years since this report was submitted have compelled drastic reduction in the illustrations. This task, with other editing, has been generously and judiciously accomplished by Dr Winifred Goldring, to whom for such and other assistance I am deeply indebted.

Meanwhile more than 200 geologists have attended a Catskill meeting of the New York State Geological Association (April 1940), in the circulars for which meeting a new term, "Saugerties shaly limestone," was proposed for what we have been calling "Schoharie" in this area. This name will now yield to that of "Leeds facies" applied (Goldring and Flower, 1942, p. 673, 681) in a paper that throws a flood of light on our "grit" beds.

Several papers published in the interim and now inserted in the bibliography have matter of importance. Mencher (1939, p. 1786) offers "Catskill alluvial plain" for "Catskill delta" of writers. He anticipates in print some ideas of the present pages in a refined study of the nature of our continental sediments, concluding (pages 1779-88) that they were derived from rapid erosion of freshly rising Acadian mountains not far to the east, in New England. Krynine's general studies (1940, 1941) are confirmatory of this. A paper by Anderson (1941) bears indirectly upon it.

Cooper (1941) has reached correlations close to those herein stated as to the Hamilton members on our quadrangles (see figure 57). As further explicated in letters to Doctor Goldring, his correlations seem to be about as follows:

Local names	*Feet*	*Berne quadrangle*	*Reference section*
		Moscow	Moscow
Kiskatom *	2600	Kiskatom	Ludlowville Skaneateles
"Ashokan"	300	? Panther Mtn.	Marcellus: Cardiff
Mount Marion	800	Otsego	Marcellus: Cardiff
Bakoven	200		Marcellus: Chittenango and lower beds
Total	3900		

* Probable place of the type Ashokan.

Moore (1941) has selected our new exegesis of the "Catskill delta" to illustrate his review of the progress of stratigraphic interpretation in the past half-century; but his chart fails to incorporate newer correlations and measurements then available. Some recent papers, not here indexed, have stressed an asserted paleontological affinity of the Tully limestone to the Upper Devonian; in the face of the stratigraphic evidence (see figure 56) and the general "Hamilton" aspect of the faunal list, this testimony seems unconvincing.

The new correlation chart of the Silurian (Swartz 1942) recognizes the fluctuating value of the terms Rondout and Manlius, but it has no column for eastern New York. Verifying our prediction, the discovery by Howell (1942) of both Normanskill and Snake Hill fossils in the Kingston region shows that the overthrust plane between these formations re-emerges southward near that city, thus follows the belt of our "little mountain" folding (Davis 1882). In another paper, Howell (1942) adds to our list of Esopus fossils. Kay (1940) has restudied the Taconian orogeny closing our Ordovician, while Parker (1942) blinking Mencher's evidence of Acadian movements assigns all our joints in Silurian and Devonian rocks to the Appalachian mountain-folding.

Cressey (1941) classifies anew our physiographic divisions, putting the Schooley peneplane on the mountain tops, whereas Cole (1941) says it is at the next lower level (2000 feet), identifying its age as Jurassic.

Rich (1941) has a last say on the inevitable stagnation and burial of glacial ice behind any higher threshold of rock or moraine, a view that accords with ours as to the inner gorge of the Hudson.

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EDITOR'S NOTE: Quoted material has been edited in conformity with editorial practices of the New York State Education Department.

FINAL ADDENDA

In the carefully thought-out correlation chart of the Devonian by Doctor Cooper (Dec., 1942; Geol. Soc. Amer. Bul., 53: facing page 1788), our "Erian" rocks are determined as follows:

Kaaterskill sandstones	Tully (perhaps also Geneseo)
Kiskatom red and green beds	Moscow Ludlowville Skaneateles plus Mottville
Ashokan sandstones Mount Marion shale and sandstone	Pecksport, Solsville, Bridgewater } Cardiff dark shale Chittenango black shale
Stony Hollow sandstone	Cherry Valley
Bakoven shale	Union Springs

On our map the Stony Hollow sandstone is included (as originally) in the Mount Marion beds and is the lower 100 feet or so (our page 107 and figure 41) that has distinct topographic expression and that overrides the "coal" at Houck's (page 171; see also 191). Both Tully and Geneseo are made Middle Devonian by Cooper (see our page 122).

For the higher (Senecan) strata, Cooper accepts our correlations, awaiting the more refined tracing that these beds unquestionably require.

Condensation may have left undetected errors in references that the reader can doubtless solve. Most of the many less important titles cut from the bibliography may easily be found in the U. S. Geol. Surv. bibliographic bulletins; those that might confuse are (*in Bul. 746:*) Chance 1880 (G4); Clarke 1884 (1885b), 1885(*a*), 1901 1902*a*), 1930(*a*); Conrad 1842(*a*); Eaton 1823(*a*), 1824 (Erie Canal); Hall 1851(*b*), 1862(*m*), 1863(*i*), 1873 (23d St. Cab.), 1878(*b*), 1893(*a*) 1894(*a*); Lesley 1882 (G6); Jules Marcou 1855(*c*); Merrill (1906(*c*); Mitchill 1798; H. S. Williams, 1900(*c*), 1910(*b*); (*in Bul. 823:*) Ernst Antevs 1; Chadwick 20; Fairchild 24; Grabau 6; G. F. Wright 2; (*in Buls. 834, 869:*) Bassler 221; Chadwick 465; Cooper 562, 751 [1934, see 1933*a*]. Chadwick 1907 is a master's thesis deposited in University of Rochester and State Museum.

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Topography by U. S. Geological Survey and the State of New York: Catskill quadrangle, 1933 and 1934 (revised); Kaaterskill quadrangle (west of 74° meridian) 1892.

GEOLOGIC MAP OF THE CATSKILL AND KAATERSKILL QUADRANGLES

Geology of the Catskill quadrangle (Silurian and Devonian on west side) by George Halcott Chadwick, 1938. Geology of the Kaaterskill quadrangle by George H. Chadwick, 1934-35. (Quarries not mapped)

Scale 62500
Miles
Feet
Kilometers
Contour interval 20 feet
Datum is mean sea level

Map 1 Silurian and Devonian Geology of the Catskill and Kaaterskill Quadrangles

New York State Museum Bulletin
Published by The University of the State of New York

No. 337 ALBANY, N. Y. December 1944

NEW YORK STATE MUSEUM

Charles C. Adams Ph.D., *Director*

ONE HUNDRED SEVENTH ANNUAL REPORT OF THE NEW YORK STATE MUSEUM

CONTENTS

ALBANY
THE UNIVERSITY OF THE STATE OF NEW YORK
1944

M374r-Mr44-2000

New York State Education Department
The New York State Museum, June 17, 1943

The Honorable George D. Stoddard
President of the University and
Commissioner of Education

SIR: I beg to submit herewith the report of the Director of the New York State Museum for the period from July 1, 1942, to March 31, 1943.

Very respectfully

CHARLES C. ADAMS

Director

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ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1944

ILLUSTRATIONS

THE LEGAL STATUS OF THE NEW YORK STATE MUSEUM

All scientific specimens and collections, works of art, objects of historic interest and similar property appropriate to a general museum, if owned by the State and not placed in other custody by a specific law, shall constitute the State Museum. [*Education Law,* § 54.]

The Librarian of any library owned by the State, or the officer in charge of any state department, bureau, board, commission or other office may, with the approval of the Regents, transfer to the permanent custody of the State Library or Museum any books, papers, maps, manuscripts, specimens or other articles which, because of being duplicates or for other reasons, will in his judgment be more useful to the State in the State Library or Museum than if retained in his keeping. [*Education Law,* § 1115.]

THE FUNCTIONS OF THE STATE MUSEUM

"The Museum is the natural scientific center of the State government; it is the natural depository of all the material brought together by the state surveys; it is the natural custodian of all purely scientific state records; it is the natural center of the study of the resources of the State as a political unit; it must maintain its capacity for productiveness in pure scientific research—pure science has been the justification of the State Museum from the beginning of its history. * * * In brief, the distinctive sphere and scope of the State Museum corresponds with the scientific interests and welfare of the people within the geographic boundaries of the State.

The truest measure of civilization and of intelligence in the government of a state is the support of its institutions of science, for the science of our time in its truest sense, is not the opinions or prejudices, the strength or weakness of its votaries, it is the sum of our knowledge of nature with its infinite applications to State welfare, to State progress and to the distribution of human happiness."—*Henry Fairfield Osborn, an address delivered at the dedication of the New York State Education Building, October 15, 1912.*

THE FUNCTIONS OF A MUSEUM

"A museum is an institution for the preservation of those objects which best illustrate the phenomena of nature and the works of man, and the utilization of these for the increase of knowledge and for the culture and enlightenment of the people.

In addition to local accessories, the opportunity for exploration and field work are equally essential, not only because of considerations connected with the efficiency of the staff * * * but in behalf of the general welfare of the institution. Other things being equal, exploration can be carried on more advantageously by the museum than by any other institution of learning, and there is no other field of research which it can pursue to better advantage.

To aid the occasional inquirer, be he a laboring man, schoolboy, journalist, public speaker, or savant, to obtain, without cost, exact information upon any subject related to the specialties of the institution; serving thus as a 'bureau of information.'

A museum to be useful and reputable must be constantly engaged in aggressive work either in education or investigation, or in both.

A museum which is not aggressive in policy and constantly improving cannot retain in its service a competent staff and will surely fall into decay.

A finished museum is a dead museum, and a dead museum is a useless museum."—*G. Brown Goode, formerly assistant secretary, Smithsonian Institution.*

THE VALUE OF RESEARCH

"In the eyes of the world today the reputation of a country does not depend alone on the size of her armaments, the size of her empire or volume of her trade so much as upon the contribution she can make to the progress and happiness of mankind in art, in literature and in science.

"The development of industry depends more or less on the application of new ideas and discoveries in pure science. Successful industrial research is ultimately dependent on the prosecution of research in pure science with the object of adding to our knowledge of the processes of nature, and generally without regard to the practical applications."—*Stanley Baldwin, Lord President of the Council, Opening the Mond Laboratory at Cambridge, England. From the New York Times of February 19, 1933.*

RESEARCH AND EDUCATION

"The future of America is in the hands of two men—the investigator and the interpreter. We shall never lack for the administrator, the third man needed to complete this trinity of social servants. And we have an ample supply of investigators, but there is a shortage of readable and responsible interpreters, men who can effectively play mediator between specialist and layman. The practical value of every social invention or material discovery depends upon its being adequately interpreted to the masses. Science owes its effective ministry as much to the interpretative mind as to the creative mind. The knowledge of mankind is advanced by the investigator, but the investigator is not always the best interpreter of his discoveries. Rarely, in fact, do the genius for exploration and the genius for exposition meet in the same mind . . . . The interpreter stands between the layman, whose knowledge of all things is indefinite, and the investigator whose knowledge of one thing is authoritative. The investigator advances knowledge. The interpreter advances progress. History affords abundant evidence that civilization has advanced in direct ratio to the efficiency with which the thought of the thinkers has been translated into the language of the workers. Democracy of politics depends upon democracy of thought. 'When the interval between intellectual classes and the practical classes is too great,' says Buckle, 'the former will possess no influence, the latter will reap no benefit.' A dozen fields of thought are today congested with knowledge that the physical and social sciences have unearthed, and the whole tone and temper of American life can be lifted by putting this knowledge into general circulation. But where are the interpreters with the training and the willingness to think their way through this knowledge and translate it into the language of the street? I raise the recruiting trumpet for the interpreters." —*Glenn Frank.*

FORM OF BEQUEST

I do hereby give and bequeath to the Board of Regents of The University of the State of New York, in trust for the New York State Museum:

State Museum Council

Orange L. Van Horne
William Otis Hotchkiss
Sanford L. Cluett
Waldemar B. Kaempffert
Lewis K. Sillcox

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Alvin G. Whitney A.B. . . . . . . *Assistant Director of State Museum*
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Collaborator

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A. F. Buddington Ph.D . . . . *Temporary Geologist*
William L. Lassiter M.A. . . . . *Temporary Curator of History*
Elizabeth McCausland M.A. . . . . *Temporary Expert*
Royal E. Shanks Ph.D . . . . . . *Temporary Plant Ecologist (Botany)*

Figure 1 New York State Education Building. The upper floors are devoted to the offices, laboratories and exhibits of the New York State Museum.

ONE HUNDRED SEVENTH ANNUAL REPORT OF THE NEW YORK STATE MUSEUM

By Charles C. Adams Ph.D., *Director*
New York State Museum

ACCOMPLISHMENTS OF THE YEAR

This report covers the new fiscal year which began July 1, 1942, and ended March 31, 1943. This new fiscal year thus covers a period of nine rather than the usual 12 months of the earlier annual reports.

Although this is the 107th year of the State Museum and its antecedents, it is yet necessary to state that its primary duties throughout this period have been primarily those of a research agency, conducting scientific surveys and making special studies of the natural and human resources of the State, in relation to the economic, social and educational welfare of the people of the State. A summary sketch for the year follows:

1 Field and laboratory studies of the mineral and other geological resources of the State have been continued, with special reference to those related to war industries, particularly iron ore and other strategic materials, such as oil and gas, as well as field and laboratory work on certain quadrangles and paleontological studies. Cooperation has been continued with federal and state agencies as well as with individuals and the industries. The war has greatly intensified interest in this particular field.

2 Important field and laboratory studies have been continued in botany, zoology and entomology, although field work has been considerably restricted on account of the transportation situation and because an effort was made to concentrate on urgent problems. The important ecological study of the vegetation of Monroe county, in relation to land use, has been completed; the entomological work on blackflies and mosquitoes has been continued with important results and has been extended to war problems; local studies of birds and mammals have been continued which have an educational bearing.

3 The collections of history, art and Indian archeology have continued to grow and increase in value. The report on the Stetson-Wells, E. L. Henry Art Collection has been completed and the report has been sent to the printer. The exhibition of the E. L. Henry Collection is about completed, like that of the Hall of New York

History, and it should soon be open to the public. A special effort has been made not to overcrowd these two halls, and special attention has been given to legible explanatory labels.

4 The attendance of school classes has continued to decline, due to war conditions. For 1942–43 there were only 52 classes and 1083 students from nine counties. The total attendance for the period was estimated at 85,000. There were no funds for Sunday and holiday opening of the exhibition halls.

COOPERATION WITH STATE AND OTHER ORGANIZATIONS

During the past year the State Museum has cooperated with the following agencies or individuals:

1 New York State Department of Agriculture and Markets. Cooperative entomological studies of the European pine shoot moth and of other insect pests of ornamental trees and shrubs have been continued.

2 New York State Conservation Department. The Director of the State Museum is a member of the State Council of Parks. The geologists of the Museum staff advise the Conservation Department on the purchase of lands when mineral resources are involved. The State Entomologist has continued his studies of the Pales weevil and related weevils injurious to Scotch and other pines, and of the European pine shoot moth. The Division of Fish and Game has cooperated with the State Entomologist on the relation of mosquito control to wild life.

3 The State Department of Health has cooperated with the State Entomologist of the Museum staff on problems relating to the control of blood-sucking flies on the grounds of the State Tuberculosis Hospital at Ray Brook and on the relation of mosquito control to wild life on Long Island.

4 State Law Department. Office of the Attorney General. The Museum geologists cooperate with the Office of Land Titles on the purchase of mineral lands in the Adirondacks and on other legal problems.

5 State Executive Department, Division of State Planning. The State Museum has cooperated with the Division of Planning.

6 Cooperation within the Education Department: State Library, conducting exchanges of Museum publications; Bureau of Publications, on the publication of Bird and Arbor Day numbers of the Bulletin to the Schools.

7 Dana Natural History Society, Albany. Cooperated on a bird lecture to Albany school children on Bird Day, April 16, 1943, by Dr Arthur A. Allen.

8 United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, has cooperated on plans for scientific studies to determine the relation of mosquito control operations to wild life conservation. This cooperation is a continuation of the work begun as a state branch of the Federal Civil Works Administration (C.W.A.) mosquito control relief program, and has been extended to include cooperation with the Fish and Wild Life Service on the same series of studies and with neighboring states.

9 The National Association of Audubon Societies has cooperated with the State Entomologist on the relation of mosquito control to wild life.

10 National Research Council, Committee on the Preservation of Natural Conditions, Washington, D. C. The Director is a member of this committee, which has been studying the facilities devoted to the preservation of natural conditions.

11 The Federal Fish and Wild Life Service cooperated in furnishing bands for the bird-banding studies of the State Zoologist, and has cooperated with the State Entomologist on plans for a study to determine the relation of mosquito control work to wild life conservation.

12 City Health Department of New York City. The State Entomologist has cooperated with this department on the control of mosquitoes and on their relation to wild life.

13 Suffolk County Mosquito Extermination Commission has cooperated with the State Entomologist on methods of controlling mosquitoes in relation to wild life conservation.

14 The Nassau County Mosquito Extermination Commission has cooperated with the State Entomologist on studies of mosquitoes and their relation to wild life.

15 Eastern Association of Official Mosquito Control Workers. The State Entomologist has participated in the organization and activities of this interstate association.

16 Monroe County, Division of Regional Planning. The State Museum has cooperated on an ecological vegetational survey of the county, in relation to land use.

STATE AND COUNTY PLANNING

As the State Museum has always been devoted to the study of the mineral, plant and animal resources of the State, its work has a fundamental relation to all programs for the proper use of these resources. The publications and files of the State Museum are the main reservoir of information on these resources. Wise public policies and planning can not ignore this kind of information. The needs for such information have increased, however, much more rapidly than the facilities for the acquisition of such information. Some phases of these problems have been discussed in former Annual Reports (St. Mus. Bul., 310, p. 121–41; Bul. 306, p. 87–96).

A local study is complete on the relation of a vegetation to land use in Monroe county, in cooperation with the local Division of Regional Planning.

In general, local planning boards can not be expected to conduct the essential scientific surveys needed, and these should be made in cooperation with the State Museum. In general also, it is only when such studies reach the engineering stage that scientific aid is no longer necessary.

STATE COUNCIL OF PARKS

The State Council of Parks, in the Department of Conservation, is the "central advisory agency for all parks and parkways, and all places of historic, scientific and scenic interest." The Director of the State Museum is a member of the council and has attended regularly the monthly meetings and inspection trips through the parks and parkways.

RELATION OF MUSEUM EXHIBITS TO SCHOOLS AND COLLEGES

With the present fiscal year of nine months, the spring attendance of classes is of course not included, but with the war restrictions on travel attendance was very limited. The number of classes from nine counties was 52, with an attendance of 1083, and class average of 21. The only counties represented were: Albany, Columbia, Delaware, Franklin, Montgomery, Rensselaer, Rockland, Saratoga and Schenectady. There were no classes from other states, as has been customary. The maximum class attendance was in 1936–37, with 402 classes and 12,444 students; for 1939–40 it declined to 361 classes and 10,474 students; for 1941–42 to 245 classes and 6500 students.

The attendance for the past 16 years, as recorded by the State Museum guide, follows:

Year	*No. classes*	*No. students*	*No. counties*
1927–28	200	3 500	13
1928–29	175	4 750	21
1929–30	235	6 308	25
1930–31	264	7 128	30
1931–32	253	6 726	28
1932–33	309	7 981	31
1933–34	301	8 769	28
1934–35	333	8 364	36
1935–36	445	12 315	39
1936–37	402	12 444	38
1937–38	387	11 697	41
1938–39	402	10 912	36
1939–40	361	10 474	47
1940–41	377	10 453	31
1941–42	245	6 500	33
1942–43 (9 months)	52	1 083	9

Monthly Class Attendance 1942–43

	1940–41		*1941–42*		*1942–43*	
	Classes	*Attendance*	*Classes*	*Attendance*	*Classes*	*Attendance*
October	58	1 569	31	914	11	256
November	24	529	34	867	12	242
December	12	239	11	297	5	146
January	14	334	11	242	8	112
February	17	401	7	119	5	118
March	35	1 221	27	654	11	209
					52	1 083
April	37	1 075	48	1 241		
May	88	2 594	43	1 255		
June	92	2 491	33	911		
	377	10 453	245	6 500		

Classification of Visiting Groups

	1940–41	*1941–42*	*1942–43*
City high schools	24	17	3
Rural high schools	42	15	2
City junior high schools	15	12	3
Rural junior high schools	22	14	1

For the duration of the war we can not expect a return to normal school attendance, although we may expect an increased local attendance.

ANNUAL ATTENDANCE TO EXHIBITION HALLS

The annual attendance to the exhibition halls is estimated because an actual count is not possible, except in the case of school classes. No funds were provided for opening the halls on Sundays and holidays. During normal times the annual attendance is estimated at about 200,000. In 1940–41 it had dropped to about 170,000, in 1941–42 to 150,000, and for the current year to about 85,000.

INFORMATION AND PUBLICITY

Museums as research and educational institutions are devoted both to the discovery of new facts and relations and to the diffusion of these. The exhibition halls provide one of these methods of diffusion; Museum publications, which have been distributed to libraries over the State and elsewhere, constitute another method for reaching an extensive public, with an influence extending over long periods of time. It is not at all unusual to find that publications printed 25 or even 50 years ago are still in frequent use. At present we have no satisfactory method of measuring the full diffusion value of important publications.

As exhibits are only a small part of the Museum's collections, many visitors call at the offices to consult the study or stored materials, just as they consult the books from the stacks of a library, or they may come for a conference with members of the staff.

Press releases are a means also of keeping the public informed of the results and functions of the State Museum.

Requests are made for public lectures, but with limited travel funds, and without official automobiles, only a few lectures are given. During the past period only about 500 were reached.

PRINTING AND PUBLICATION

"If you would not be forgotten as soon as you are dead and rotten, either write Things worth reading or do Things worth the writing."—*Benjamin Franklin*

"After all it is the written word that lives."—*Dr W. M. Beauchamp*

Printing during the period of this report has been particularly slow, with the result that not a single serial publication has appeared during this interval, although several important publications are in process of printing. The printing of lithographic geological maps has been delayed by war conditions.

Accompanying this report on pages 67–68 is given the Annual Museum Bibliography of papers by the staff, and papers which at least

in part are based on the Museum collections or are the result of some form of cooperation with it. Years of experience have emphatically indicated that a satisfactory printing and sale policy for State Museum publications is not likely to be developed until a careful, comprehensive, technical study is made of the whole subject. The printing of donated manuscripts and the acceptance of printing funds are phases of the problem that merit careful study.

CONDITION OF THE EXHIBITION HALLS AND EXHIBITS

(Figures 2–20)

The renovation of the floors and walls of the State Museum is still in process. During the past season very important work has been done in repainting and cleaning the cases and exhibits in the Halls of Geology and Paleontology. During the late spring and summer of 1942, the installation of the Lithgow historic murals depicting the history of New York State was completed in the Hall of New York History, and in the wall cases from the World's Fair are displayed objects intended to indicate the history and the life of the people of the State. This exhibition includes materials related to the French, Dutch (figure 4), the French and Indian War, the Revolution, Civil and Spanish Wars (figure 5). In order not to overemphasize political and military history, much of the other exhibits were devoted to industrial and cultural materials, such as household equipment (figure 6), tools of various kinds, precision instruments, as scales, callipers, thermometers, quadrants—for the clipper ships and whalers (figure 7), medical history (figure 8), costumes (figures 9–10), coverlets (figure 11), stoneware (figure 12), glass (figure 13), pewter, silver (figure 14), and the evolution of lighting from the candle to the electric light (figure 15). A special exhibit is devoted to Joseph Henry, including Flanagan's statue of Henry, whose birthplace is Albany, as shown by a photograph (figure 16), with examples of some of his original equipment used in his discovery of the induction of electric currents, even including the *original* little bell that was first rung by electricity, and thus paved the way for all telephone bells. Without question Henry is the most important man ever born in this part of the world and deserves real emphasis. As stated on the label for this exhibit, the work of Henry in America and Faraday in England laid the foundation for the modern electrical industry.

Another aspect of Joseph Henry's contribution to society has not received much emphasis, but is a phase of increasing importance—his

application of the methods of science to governmental problems, so well expressed by Crowther, as indicated in the label, which reads:

ESTIMATE OF JOSEPH HENRY'S WORK

"In total achievement Henry was the equal of Faraday, Helmholtz, Kelvin, Maxwell, and the other great scientists of the nineteenth century. He did not discover so many important new facts and theories as Faraday, but he contributed vastly more to the organization of scientific research. As G. B. Goode has explained, Henry 'did much toward establishing the profession of scientific administration—a profession which in the complexity of modern civilization is becoming more and more essential to scientific progress.' This is an important remark. The creation of methods of organization is even more urgent, in the conditions of modern civilization, than the discovery of such a profound phenomenon as electromagnetic induction. Society is being disrupted by the scientific forces which have been released within it."

J. G. CROWTHER

"Famous American Men of Science" p. 162. 1937.

"In the same way consider the importance of the founding of the Royal Institution, where Faraday did his work on electromagnetic induction; and of the Albany Academy, where Joseph Henry made his great contributions in this same field. Our whole electrical industry is based on the work of these two men."

Dr. WILLIAM D. COOLIDGE
Schenectady, N. Y.

It should also be noted that the telegraph invented by S. F. B. Morse was developed as an outgrowth of the induced current of electricity (figure 16). The telegraphic instruments shown call this to mind, and as well a portrait of Morse, an autograph, a pen and an ink drawing by him, recall that he was also an artist.

The telephone, invented by Alexander Graham Bell, indicates that he also used the induced electrical currents (figure 16) to transmit messages, and finally radio outfits are a later extension of these same current developments. The striking statue of Joseph Henry by John Flanagan calls emphatic attention to the exhibit and helps to reinforce this exhibit which is probably the most important objective exhibit in this New York History Hall.

Six cases are devoted to the work of New York artists, such as Van Zandt, Charles H. Moore, Worthington Whittredge, Thomas Pope, Will H. Lowe, Daniel Chester French, Edmund J. Sawyer and M. Arthur Cohn (figure 17).

In the Temporary Exhibition Hall an exhibition from the Stetson-Wells, E. L. Henry Art Collection was installed in September 1942. A careful study of the Henry Collection was made by Elizabeth McCausland in connection with her study of the life and work of

Henry, as well as a preliminary plan for its exhibition. With the able volunteered assistance of Wilfred Thomas and Frank M. Thomas this exhibit was installed.

The accompanying photographs (figures 18–19) indicate the general character of the E. L. Henry exhibit. The arrangement is in general in chronological order, giving examples of his early, intermediate and later work, accompanied by sketch book drawings, studies and completed work or photographs of the final painting. The exhibition is an outline or sketch of the life work of the artist and contains drawings of considerable historic interest (the Civil War scenes) in addition to their artistic merit.

With the additional storage space on Central avenue it was possible to locate and examine historic material that had been boxed for so many years that it had become unknown to the staff. This consisted of a large donation of French and Indian and Revolutionary war material donated in 1911 by Silas H. Paine of Lake George. This furnished very valuable materials for the Ticonderoga and Saratoga exhibits.

CONDITION OF THE STORAGE FACILITIES

The additional storage space at 95 Central avenue has proved, as mentioned above, very valuable, but it is inadequate to care for all the material needing proper storage space. The geological and historical materials now in the abandoned St Agnes School, remain exposed to vandals and the risk of fire. Actually there was a fire in the building during the past season. The valuable collections in this building and a considerable amount cluttering up the offices and hallways in the Education Building should be removed in the near future.

PHOTOGRAPHY AND DRAFTING

The position of photographer and draftsman has not been filled since January 7, 1938, with the result that every phase of the work of the State Museum has been seriously impeded. This is particularly true because of the difficulty of using the Museum files of negatives, slides and photographs to the best advantage, and of securing maps, drawings, labels and photographs promptly when needed. The State Museum needs urgently not only a full-time photographer, a full-time draftsman, but a full-time scientific artist. The unsatisfactory status of the Museum dark room continues to interfere with photographic work.

In addition to the technical work there is a vast amount of clerical work of indexing and filing the negatives, photographs and drawings, for which there has never been any adequate provision, and the effect of such a policy is unfortunately cumulative, and will require considerable extra work, at some future time, to restore the collections to order.

Two very welcome recent donations are fine examples in plaster of Houdon's sculpture. These portraits, slightly larger than life, of George Washington and Benjamin Franklin, are superb examples of Houdon portraiture. The Washington bust was donated by Judson S. Landon, and the Franklin bust by the Deaconesses of Maple Hill, Upper Red Hook. As in the case of many others, these gifts came through the friendly services of Wilfred Thomas.

MUSEUM COLLABORATORS

The only Museum Collaborator presently engaged under the April 18, 1929, authorization of the Board of Regents, is Dr E. P. Felt.

STATE MUSEUM COUNCIL

The State Museum Council is an advisory group appointed by the Board of Regents to advance the general welfare of the Museum.

There was no meeting of the Council called this year.

THE HISTORIC AND ART COLLECTION

(Figures 2–20)

"I warmly sympathize with the ambition expressed in your annual report to have this Museum more than a mere zoologic or scientific museum. It should be a museum of arts and letters as well as a museum of natural history. * * * There should be here a representation of all our colonial and revolutionary life. There should be in this Museum for the instruction and inspiration of our people, a full representation of American history since the time when New York cast off its provincial character and became an integral portion of the American Republic."—*Theodore Roosevelt's address at the opening of the New York State Museum, December 29, 1916.*

With the termination of the W.P.A. on May 15, 1942, work on the History and Art Collection slowed down, except the installation of the E. L. Henry exhibit in the Temporary Exhibition Hall, and in the Hall of New York History, the initial stages of which were discussed in the preceding Annual Report.

The method of installation of the E. L. Henry exhibit is shown in figures 18–19, and in the Hall of New York History in figures 2–16. Attention has been called to the recovery of the valuable Silas H.

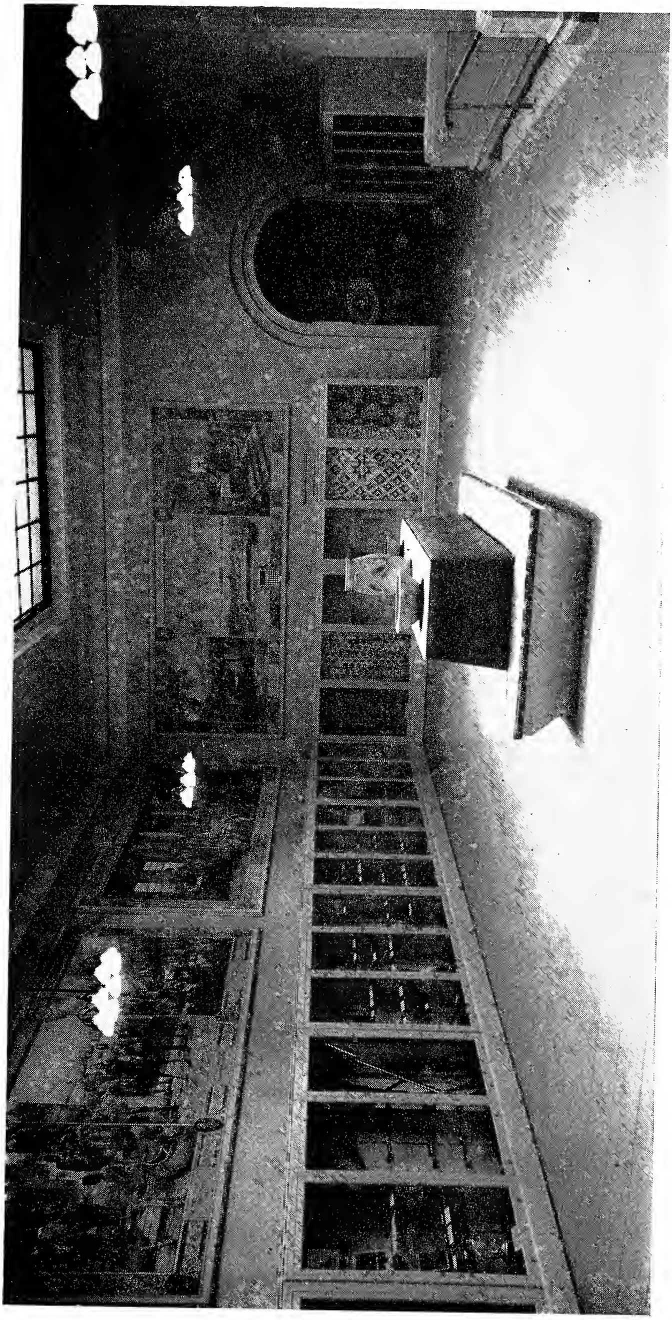

Figure 2 General view of the east end of the Hall of New York History

Figure 3 Exit from the E. L. Henry exhibit to the Hall of New York History; statue of Joseph Henry on right

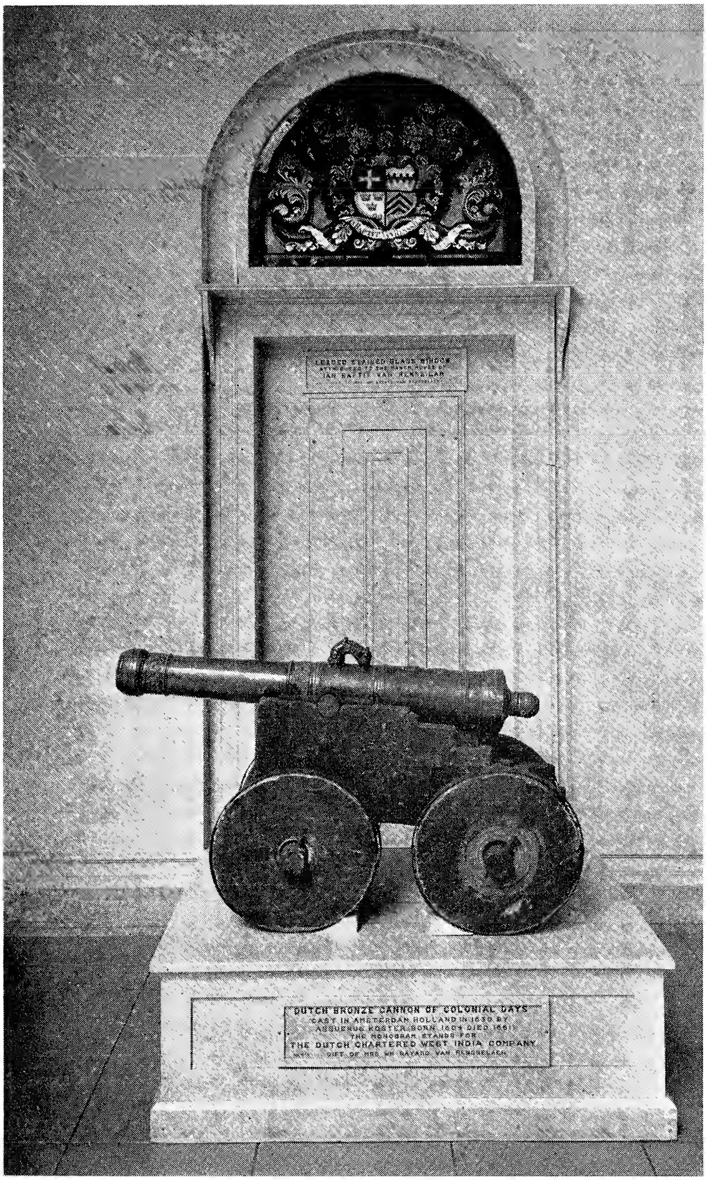

Figure 4 Stained glass window of Ian Baptit Van Renssilar, and cannon cast at Amsterdam, Holland, 1630

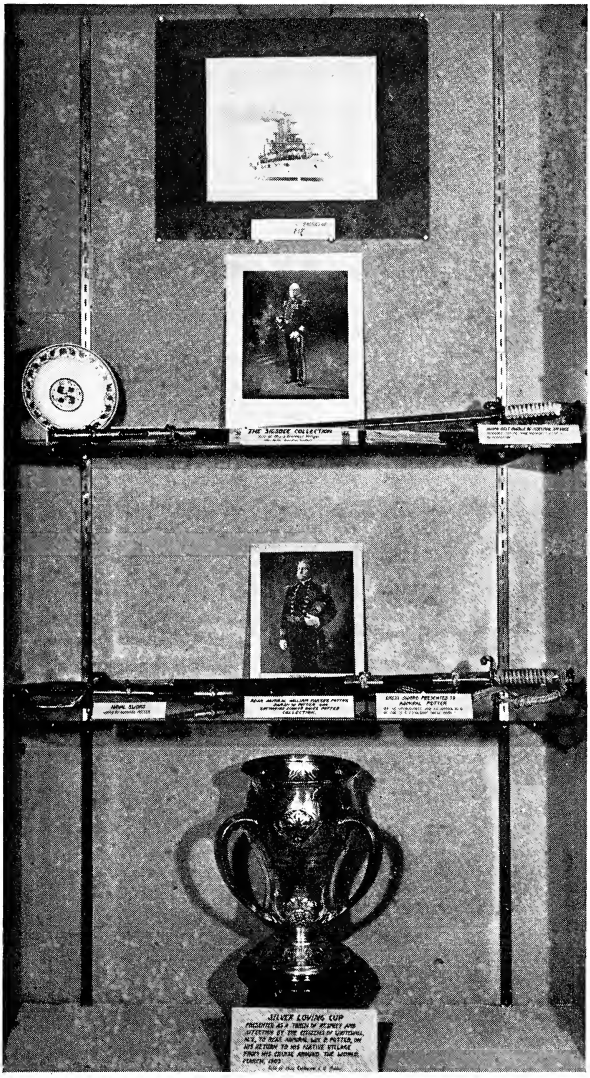

Figure 5 Photographs of the Battleship "Maine," Admiral Charles D. Sigsbee and Admiral William Parker Potter, of the Spanish War

Figure 6 Household equipment

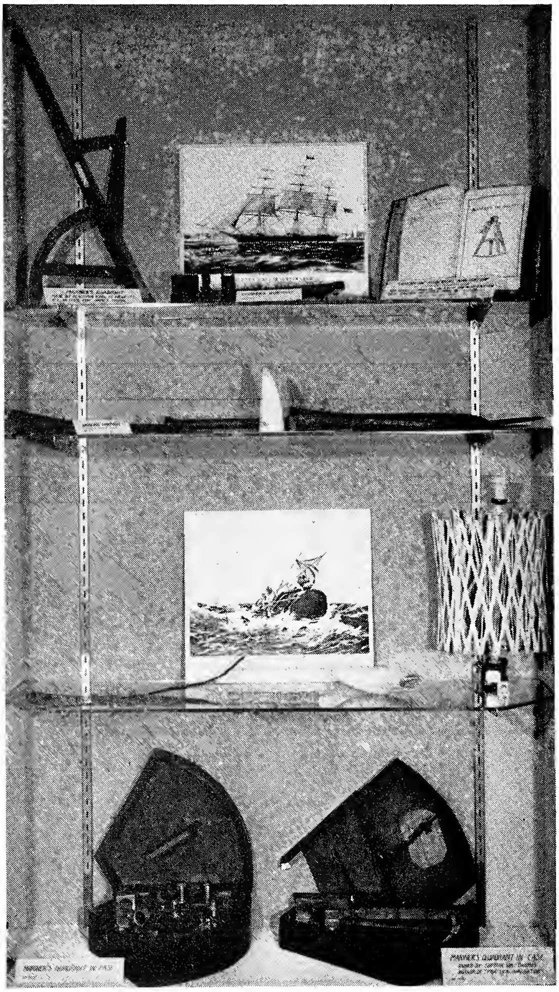

Figure 7 The conquest of the sea: navigation, the quadrant, clipper ships and the whalers

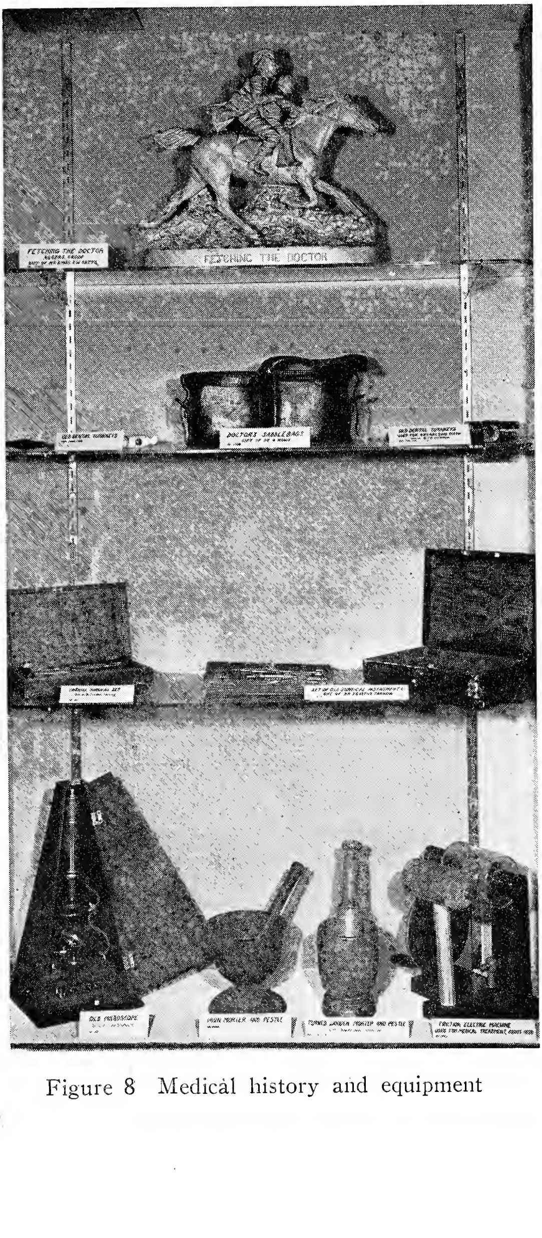

Figure 8 Medical history and equipment

Figure 9 Woman's costume of about 1835 in New York City

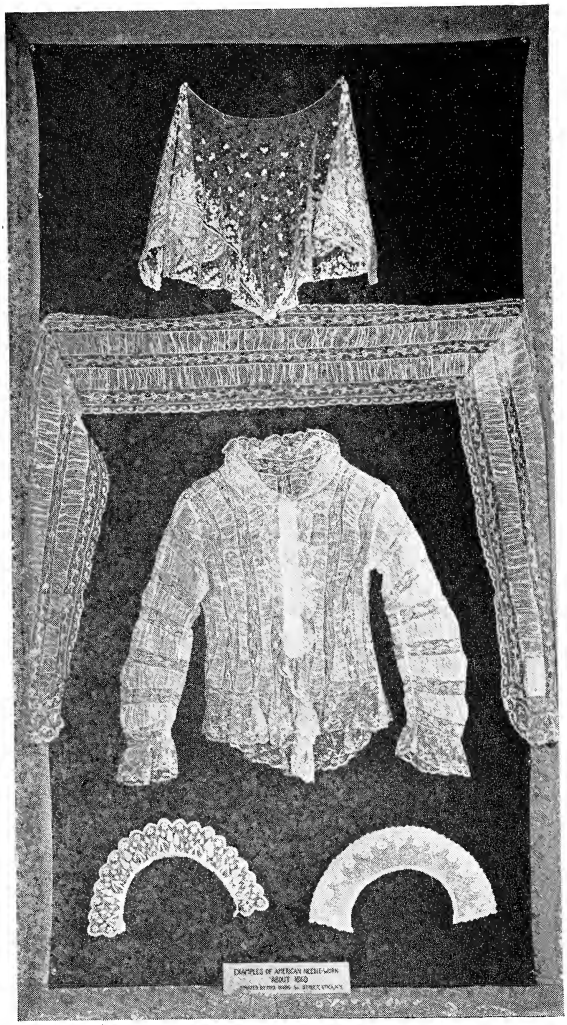

Figure 10 Lace of about 1860

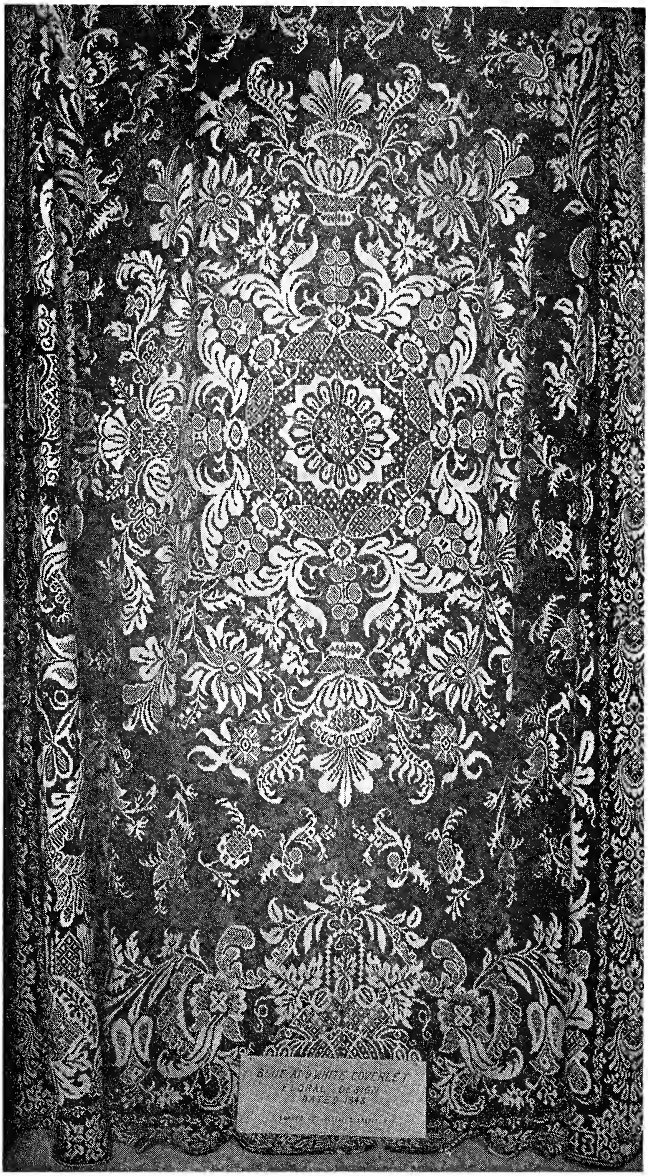

Figure 11 Coverlet of 1843

Figure 12 New York State stoneware

Figure 13 Old glass and china

Figure 14 Old pewter and silver

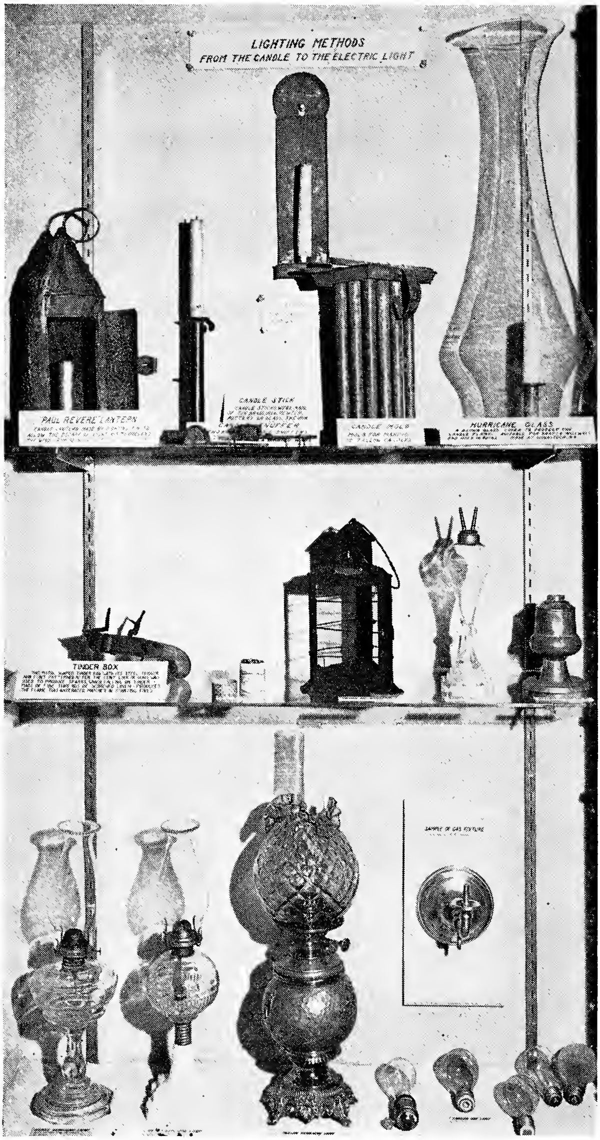

Figure 15 From the candle to the electric light

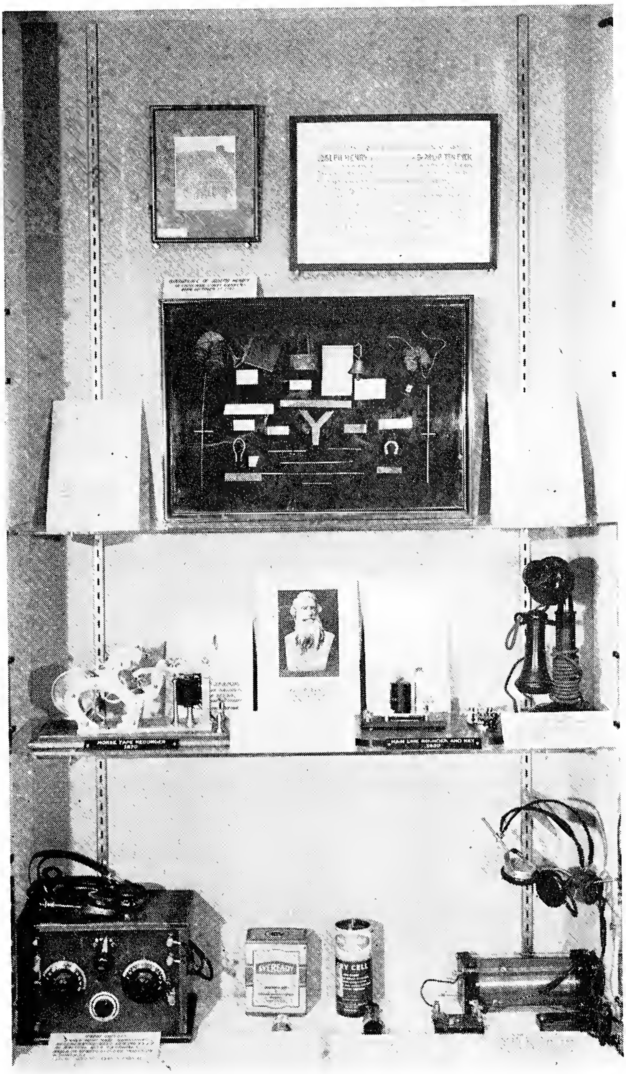

Figure 16 Joseph Henry's laboratory equipment; the telegraph, the telephone and the radio

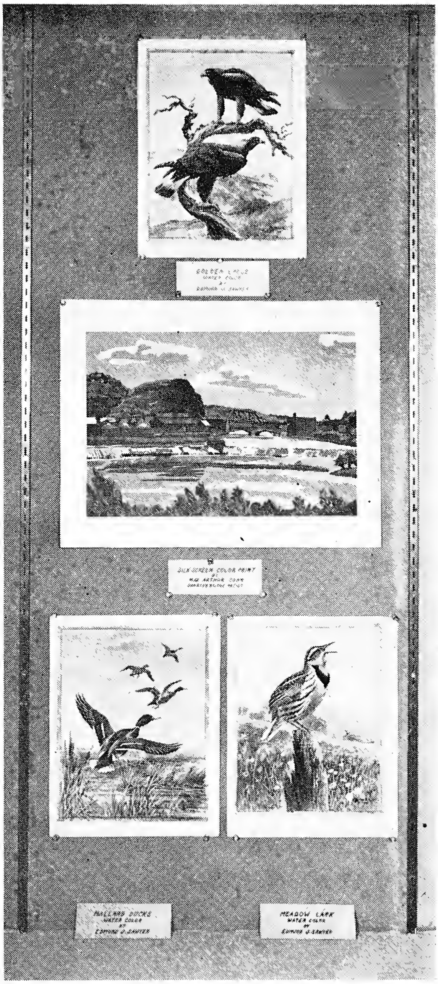

Figure 17 Water colors of birds by Edmund J. Sawyer, and silk screen by M. Arthur Cohn

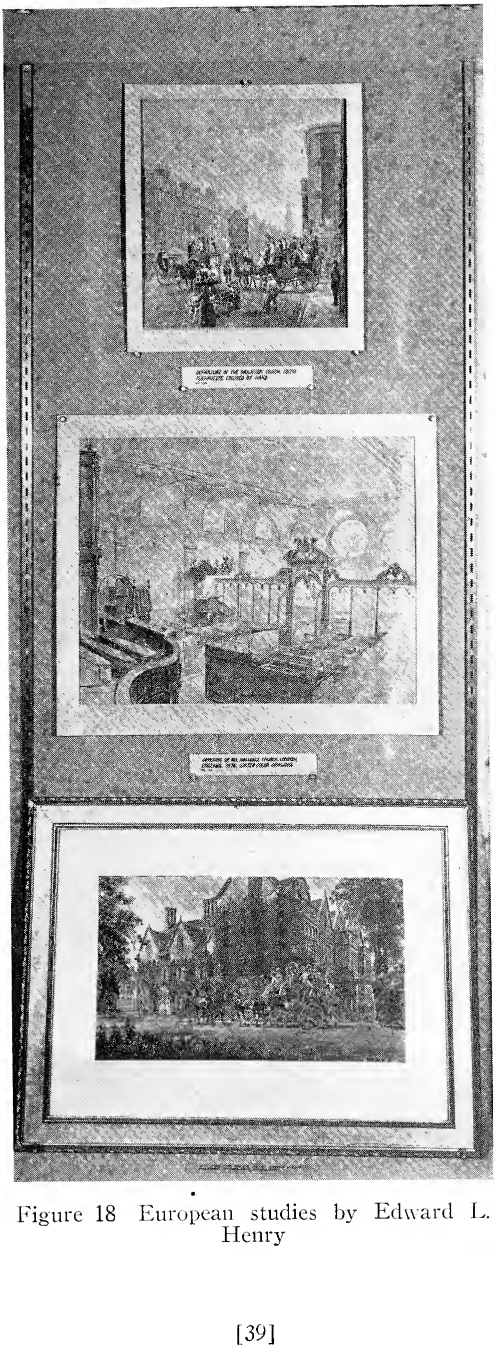

Figure 18 European studies by Edward L. Henry

Figure 19 Portrait of Edward L. Henry by C. C. Curran N.A., and memorabilia of Henry

Figure 20 "Fighting Peacocks," Anna Hyatt Huntington, sculptor

Paine collection, which was found when the new storage space made it possible to locate this collection and to use it.

A very notable addition to the Art Collection was the donation of two bronzes by the artist, Mrs Anna Hyatt Huntington, of "Fighting Peacocks" and "Domestic Trouble." The former is shown in figure 20.

EXHIBIT OF SILK SCREEN PRINTS

Accidentally, reference to the temporary exhibit of silk screen prints was omitted from the 105th Annual Report (State Mus. Bul. 333), and is therefore inserted here to make the record complete. This exhibit was assembled through the generous assistance of Elizabeth McCausland, of New York City, to whom and to the artists we are very grateful and to whom also we express apologies. The following statement by William L. Lassiter, who displayed the exhibit, is from the press notice he prepared:

The New York State Museum will exhibit during July and August 1940, in the Museum rotunda, the first general exhibit of silk screen prints ever held upstate.

The silk screen process, a new graphic art medium, is a kind of stencil process that has been used for about 30 years in the commercial field, but only within the past two years has it been adopted in the realm of the fine arts. The process of producing prints, which preserve the personal element of the artist, even though the quantity may vary from a few to a thousand copies, is not a complicated one and the expense of production is low.

In announcing the exhibit, it was explained that the silk screen process as a fine art medium owes its popularity to Anthony Velonis, who set up a silk screen unit in the New York City W.P.A. Art Project. He saw its possibilities as a method of making inexpensive prints. The United American Artists and the Public Use of Arts Committee supported this project in the New York City W.P.A. Art Project, and Elizabeth McClausland, art critic and author, of New York City, gave aid in its development. Miss McCausland assembled the exhibit for the State Museum.

The following 23 artists are represented in the exhibit: Judson Briggs, Max Arthur Cohn, Harry Glassgold, Harry Gottlieb, F. Wynn Graham, Riva Helfond, Ernest Hopf, Mervin Jules, Beatrice Mandelman, Doris Meltzer, Eugene Morley, Elizabeth Olds, Herbert W. Pratt, Leonard Pytlak, Mildred Rackley, Hulda D. Robbins, Bernard P. Schardt, Harry Shokler, Harry Sternberg, Anthony Velonis, Sylvia Wald, Hyman Warsager, Carol Weinstock.

SUMMARY OF THE ACTIVITIES OF THE STAFF

(Figures 21–26)

"It is essential that this Museum should command the service of many different men for work in many different fields, and that its work should be so closely related to work of the same kind elsewhere that it shall all represent a coordinated whole. This is true of all departments of the work, but especially so of those departments which have a direct utilitarian bearing.

"This Museum like every other institution of the type should do everything to develop large classes of workers of this kind. And yet, friends, we must never forget that the greatest need, the need most difficult to meet, is the need to develop the great leaders, and to give full play to their activities. In the entirely proper effort to develop numbers of individual workers there must be no forgetfulness of this prime need of individual leadership if American achievement in this scientific field is to be really noteworthy. Yet in scientific as well as in historical associations and academies, this fact is often forgotten.

"The really great works must be produced by some individual great man who is able to use to the utmost advantage the indispensable work of a multitude of other observers and investigators. He will be the first to recognize his debt to these other observers and investigators. If he does not do so he will show himself a poor creature. On the other hand, if they are worth their salt they will be proud to have the great architect use all of the results of their praiseworthy and laborious and necessary labor in constructing the building which is to crown it."—*Theodore Roosevelt's address at the opening of the New York State Museum, December 29, 1916.*

From an administrative point of view a summary of the activities of the technical staff is as follows:

History, art and archeology. The installation of the Hall of New York History has been the major undertaking of the season with the assistance of William L. Lassiter, and as a volunteer adviser and assistant, Wilfred Thomas. Valuable assistance has also been received from Roger Stonehouse for the lettering of large labels, and to W. J. Schoonmaker and Louis J. Koster. Valuable cooperation has been received from Carl Hanson of the State Architect's office. Mr Schoonmaker has assisted, particularly in the labeling of the E. L. Henry exhibit.

Elizabeth McCausland has completed her report on the life and work of E. L. Henry, and it is with the printer.

Noah T. Clarke, State Archeologist, reports that he has continued the examination and classification of the study collection of Indian archeological material. A fresh supply of braided corn has permitted the repairs of the Mohawk Harvest Group.

Elsewhere in this report (p. 22) mention has been made of the exhibits in the Hall of New York History.

Botany. Dr Homer D. House, State Botanist, with the restrictions on travel for field work, has devoted himself to routine office work and the collections have occupied most of his attention (figures 21–23).

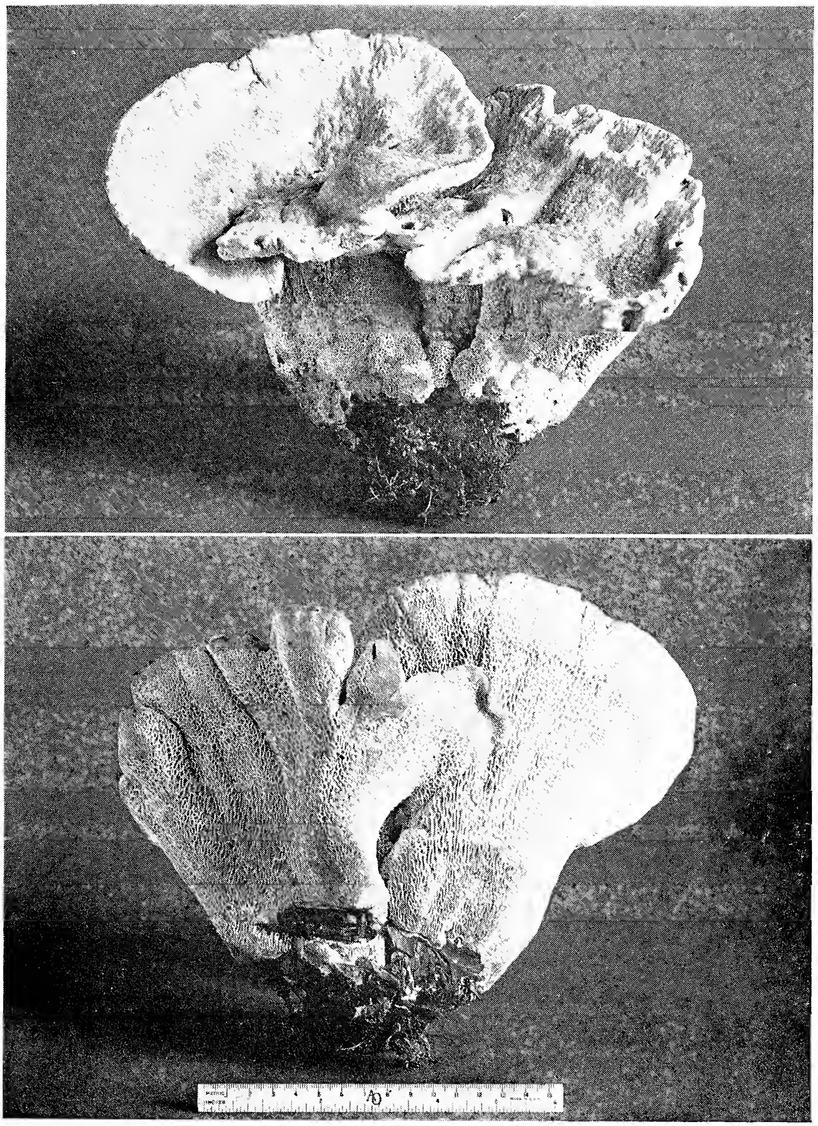

Figure 21 *Polyporus Berkeleyi* Fries. A rare fungus, parasitic on roots of the oak, found in 1942 near Grafton, Rensselaer county, by Dr John A. Sampson. Photograph by J. A. Glenn

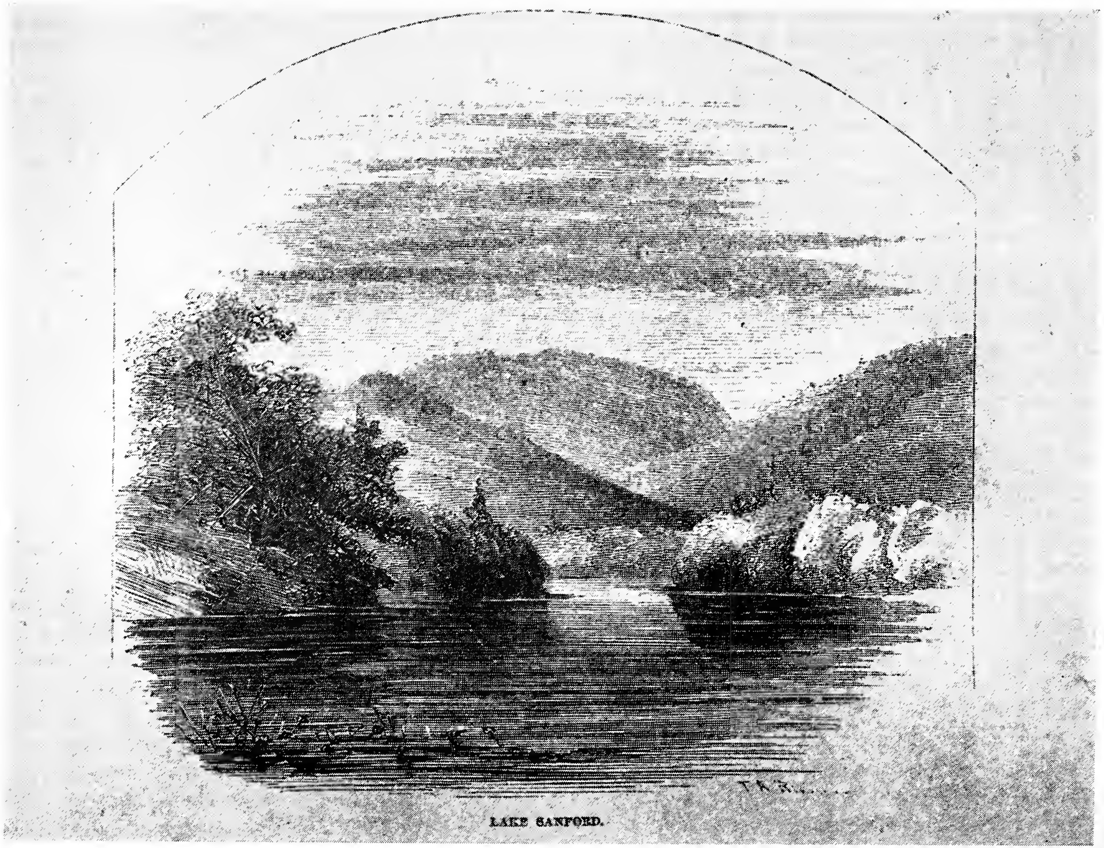

Figure 22 Lake Sanford, Essex county. Sketch published in Harper's New Monthly Magazine, p. 457, 1859

Figure 23 Lake Sanford, Essex county. A region of unusual botanical interest, site of the Old Adirondack Iron mines, and now the site of a new development for the titanium found in the iron ore. Photograph by H. D. House, July 20, 1925

Figure 24 A family of young Belted Kingfishers near Oneida Lake. Photograph by Dayton Stoner

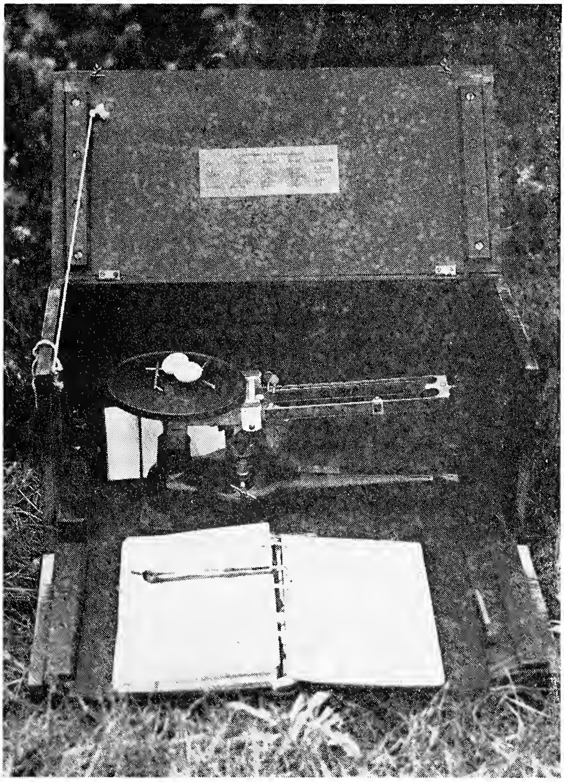

Figure 25 Scales, notebook and other field equipment used in growth studies on birds. Two mourning dove eggs rest on the pan of the balances. Photograph by Dayton Stoner

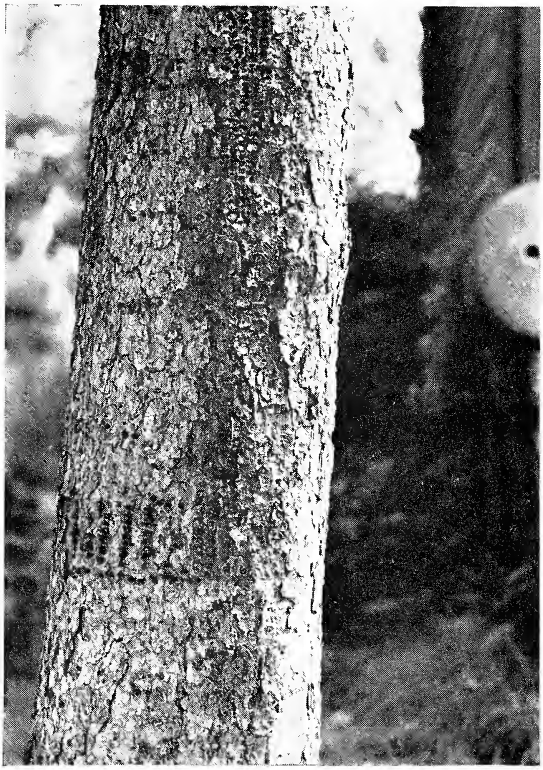

Figure 26 Work of yellow-bellied sapsucker on hemlock tree at Cleveland, N. Y. Photograph by Dayton Stoner

Dr Royal E. Shanks, Temporary Ecological Botanist, has completed his report on the cooperative survey of the vegetation of Monroe county in cooperation with J. Franklin Bonner, director of the Division of Regional Planning of Monroe county. Doctor Shanks has also cooperated with Dr R. H. Goodwin of the University of Rochester in a paper, Notes on the Flora of Monroe County, New York (Proc. Rochester Acad. Sci., v. 8, no. 5–6, 1943).

Entomology. Dr Robert D. Glasgow, State Entomologist, has continued his field and laboratory investigations of the blackflies and mosquitoes. Federal agencies in the Treasury Department and Department of Agriculture have called upon him for assistance on insect problems. He has worked out control methods for blackflies which have been approved by the Department of Conservation as not being injurious to fish. These measures may be applicable to war efforts in certain regions. At the request of the Department of Conservation he attended mosquito control meetings to aid in preventing unnecessary injury to wild life. He has continued the study of an insect-borne disease of the pig, which merits careful study.

Kenyon F. Chamberlain, Assistant State Entomologist, has continued his skilful work transferring the insect collections from the old boxes to the new steel cabinets. When once this transfer is completed the collection will not only be more accessible but will be relatively free from pests.

Geology. Chris A. Hartnagel, State Geologist, has continued his economic studies of oil and gas. As their annual value is $15,000,000, it exceeds that of any other mineral in the State. A summary of the natural gas developments awaits the maps needed before the report can be published.

Robert C. Stephenson, Temporary Geologist, has completed his report on the titaniferous iron ores of the Tahawus region.

Dr Tracy Gillette, Temporary Geologist, had completed his report on The Clinton of Western and Central New York just before his unfortunate death. This paper was intended as a part of his State Museum Bulletin 320, but was delayed.

Dr John G. Broughton, was appointed Assistant State Geologist December 1, 1942, and has been engaged in looking into mineral problems of the Adirondack region, giving special attention to talc and the dolomite limestones bordering the St Lawrence river.

Dr A. F. Buddington, Temporary Geologist, reports the war situation prevented field work in the Saranac Lake quadrangle.

Mrs Medora H. Krieger, Temporary Geologist, has about completed her report on the Indian Lake quadrangle.

Dr Earl T. Apfel, Temporary Geologist, reports war conditions have delayed the completion of his glacial geology report. Dr Chauncey D. Holmes, Temporary Geologist, has been cooperating with him.

Paleontology. Dr Winifred Goldring, State Paleontologist, has given much attention to the routine work of the office and to the renovation of the exhibits of fossils and allied work. The report on the Coxsackie quadrangle is in process of printing. Doctor Ruedemann, retired, is nearing completion of his monograph on the Graptolites.

Dr Rousseau H. Flower, Temporary Geologist, has completed his report on Devonian cephalopods.

Clinton F. Kilfoyle, Technical Assistant, has continued his work on the cataloging of type specimens, the arrangement of the study collections and in the renovation of the exhibits of fossils.

Dr G. Marshall Kay, Temporary Geologist, has completed his report on the Utica quadrangle.

Colleagues in the Department of Geology, Columbia University, of the late Dr R. J. Colony, Temporary Geologist, are completing the report on the complex geology of the Schunemunk quadrangle. Kurt E. Lowe has made good progress on this report.

Zoology. Dr Dayton Stoner, State Zoologist, has continued his study of the banding of the swallows of the Oneida Lake region, and the birds of Lincoln Park, Albany (figures 24–26).

Walter J. Schoonmaker, Assistant State Zoologist, has devoted some time to the completion of his report on the woodchuck, and has continued field work on the Rensselaer county mammals. He has also assisted in the installation and the lettering of labels for the Hall of History and the E. L. Henry exhibit.

Louis J. Koster, Technical Assistant (Taxidermy), began his duties August 17, 1942. He comes very well recommended and has had excellent experience. He has materially aided in the installation and labeling of the Hall of New York History, and has made many improvements of the zoological exhibits and collections.

The report on birds' nests by Edmund J. Sawyer, Temporary Ornithologist, has been sent to the printer.

ANNUAL FINANCIAL AND STATISTICAL SUMMARY

THE STATE MUSEUM BUDGET

The following budget does not include the cost of heat, light, janitor service, orderlies (watchmen), carpenters, painters and elevator men. Certain other items also are furnished by the Education Department, such as postage, stationery, express, drayage in part, telegraph and telephone, and are therefore not included in the budget.

Facilities provided by cooperative projects supplement to an important degree the state appropriation. It is impossible to estimate the amount of these funds precisely, since they include the federal franking privilege, cooperation with many individuals, with organizations and with other state departments. Labor, supplies, expert services, use of automobiles etc. have been provided by this cooperation. Such financial assistance is of the greatest value, but the funds do not pass through the Museum. The annual statistical summary for the fiscal year July 1, 1942, to March 31, 1943, follows:

APPROPRIATIONS AND FUNDS FOR FISCAL YEAR

(July 1, 1942 to March 31, 1943)

Appropriations and Allocations

Salaries:	
Administrative staff	$10 020
Scientific staff	34 100
Temporary expert service	2 500
Scientific assistants	4 120
Clerical, labor etc.	13 120
Total salaries	$63 860
Equipment and supplies ... Approximate	1 240
Traveling (of which $100 for out-of-state)	400
Printing ... estimated	750
Total budget	$66 250

Directory Data

Name of Museum: New York State Museum
Location: Albany, New York, U. S. A.
Name of Director: Charles C. Adams
Name of Assistant Director: Alvin G. Whitney
Date of Founding: The Museum is the outgrowth of state surveys begun in 1836; formal organization of the Museum was effected in 1843. (See State Museum Bul. 313, p. 85–121, 1937, for historical sketch.)
Open to the Public: Open week days from 9 a.m. to 5 p.m. Closed on Sundays and legal holidays. The total number of days open to the public for fiscal year of 9 months, is 226; total hours, 1808.

RETROSPECT AND PROSPECT

Status of the State Museum. The present Director assumed his duties May 1, 1926, and retired July 31, 1943, an interval of about 17 years. A few observations on the major activities of the State Museum during this period may be instructive as well as interesting. Perhaps nothing outstanding has taken place, but this sketch may nevertheless aid in understanding the general situation. A new State Museum building, needed for many years, has not materialized; salaries of the staff, which were excessively low, have improved somewhat but are not yet up to standard for comparable skill in the better museums and universities. The meager staff has declined rather than increased in number. Before the world-wide economic crash occurred, the Education Department underwent its greatest period of expansion, but this did not extend to the State Museum. Interested friends even suggested that the State Museum should be taken out of the Education Department, and have its own trustees, like the state colleges, in order to have a group devoted to its interests who would concentrate solely on the welfare of the State Museum. During this same period the museums of this country and the various research institutions have expanded at an unprecedented rate.

The functions of the State Museum, as determined by law and by precedent, have been fundamentally those of a research institution, conducting geological and natural history surveys and studies of the State along scientific, economic and education lines, and during the past 50 years gradually expanding its field to include the history and the art of this State. The exhibits—sometimes erroneously called "the Museum"—are a natural outgrowth of the scientific and educational work, but an adequate staff of technicians has never been provided to develop properly the educational phase of the work. The metropolitan museums, which have an unusual opportunity for making conspicuous displays appealing strongly to wealthy donors, have been more successful in securing funds for such exhibits than have the tax-supported museums. Although the Board of Regents has authority to administer trust funds, trust funds have not been forthcoming, as they have for large semipublic museums. Fluid funds of this character would be of great value for initiating work in advance of public support. There are, of course, disadvantages in this system. Gift funds are commonly not given where most needed, but conform to the wishes of the donor, who rarely comprehends the situation or cares to be told how to spend his money, with the result that funds are often spent lavishly for some projects while others, even more

important, starve. As a result there is a lack of balanced or symmetrical growth.

Fortunately the New York State Museum differs from most other state museums in that it conducts the state scientific surveys of geological and natural history and includes also within its field both history and art. Commonly a state museum is merely an exhibition museum, and does not conduct scientific work, and often it is not a general museum, but is restricted in some way. The New York State Museum is, however, a comprehensive state agency. This is not generally understood by state officials or the general public. With its broad functions and with its connection with the Education Department and other State Departments, the State Museum should really become the central general scientific and cultural agency of the State Government. For this, understanding of its potentialities and adequate support are needed.

Educational emphasis. All previous Directors of the State Museum have been geologists. The present Director is by training a zoologist and ecologist, with an interest in geography and geology. In making the appointment of a Director with a background different from that of his predecessors, the Regents gave him to understand that it was desirable for him to balance the functions of the State Museum and to stress its educational aspect more than it had been in the past. In harmony with this advice two proposals emphasizing the educational approach were made to the Regents in June 1926; one was a plan of cooperation with the schools in the development of school museums, and the second was a proposal to cooperate in the conduct of an outdoor school of natural history in the Allegany State Park. The Regents approved only the plan for the outdoor school. This school was intended to indicate how the educational system could make greater use of the extensive and unique park system of the State for educational as well as for recreational purposes. For about a decade this work prospered. Several hundred teachers and students were trained at this school, and other schools have adopted its methods.

The conduct of this school provided the facilities and environment for intensive, scientific and educational studies of the natural history of the Allegany State Park, and the State Museum handbooks were largely an outgrowth of this work. These popular handbooks were prepared by competent naturalists who made first-hand investigations and wrote from immediate experience. Previously only a few of the publications of the State Museum were popular in character. These handbooks were made pocket size, freely illustrated, and contained

original material or were a summary of the knowledge on the subjects treated. Many of these handbooks were used as textbooks at the Allegany School of Natural History and by teachers in general, as well by the general public, with the result that some were soon out of print. No other state park has been so carefully studied and the results made available in popular form. These handbooks are thus all that remains of the educational program, and once more this emphasizes Dr William M. Beauchamp's remark that "After all it is the written word that lives," and further confirms the importance of publications in a program of educational work.

History and the industrial arts. A short time after the Director began his duties at the State Museum and attempted to orient its functions, it became evident that the weakest and most neglected phase of its work was in relation to history and the arts, in spite of the fact that the law provided for both. The visiting public sensed that there was an overemphasis on the natural sciences, particularly of geology, which occupied half of the exhibition space.

Here was the State Museum located in Albany, which was an old Dutch colonial community, at the confluence of the Hudson and Mohawk valleys, whose strategic position was the goal of Burgoyne's campaign, which served as the turning point in the American Revolution; the terminal of the Erie and Barge canals and all that this implies for the development of the interior of the continent; the birthplace of Joseph Henry, the most important scientist born in this region, and finally the seat of the State Government concerned with about one-tenth of the population of the United States. In such a setting should history, industry and art be ignored in an educational program of the State Education Department, as far as the State Museum was concerned?

The burning of several Shaker buildings at Watervliet, a few miles away, called attention in an emphatic manner to the rapid destruction of important historic materials. Clearly something should be done about it. The Shakers came to America in 1774, settled near Albany and became the most successful experiment in communistic living ever made in America. This religious society, whose leader was Ann Lee (figure 27), contributed much to the industrial and social life, not only of this region, but as well of several other states. The Shakers originated the seed package business, did an extensive herb business, prepared dried vegetables and fruits, made chairs, and on account of their large communal families developed mass production methods that were readily expanded to a large business conducted in many states.

Figure 27 Alleged portrait of Ann Lee, founder of the Shakers (From W. Oxley, *Modern Messiahs*, Landon, 1889)

Since the sect was declining rapidly and antiques were in demand, the objects of historic interest were becoming scattered and destroyed. Here was an important phase of the industrial history of the State that was worthy of preservation, irrespective of other considerations.

Accordingly a program of acquisition and preservation of significant Shaker material was inaugurated which has resulted in the best collection of its kind in any museum, although there is today no exhibition of this material in the State Museum.

It is important to note, however, that the Historic Collection has not been limited to Shaker materials. Many years ago my immediate predecessor, Dr John M. Clarke, had expanded the agricultural collection, and valuable donations of household and other significant material, including stoneware, glass, textiles and silver have been made. There are in addition special collections such as the Admiral Charles D. Sigsbee Collection, the Catharine Eights Boies Potter Collection, the Cosman-Gardner Collection, the Frederick C. Hirons Architectural Collection and the Silas H. Paine Historical Collection, which cover a wide range of material in the industrial and other arts. The earliest phase of history to receive emphasis in the State Museum was the life of the New York Indians, probably due to the influence of Lewis H. Morgan and W. M. Beauchamp. The Iroquois Indian Groups and the ethnological exhibits have continued this interest.

Only a beginning has thus been made in this general historical field, and much remains to be done, but additional exhibition and storage space must be provided, as well as a curator, before any important advance can be expected.

The fine arts. As there is no sharp distinction between history, industrial history and the fine arts, a number of fine arts materials were included in the Historic Collection, such as paintings, etchings, medals, pewter, silver, architectural drawings, photographs and some sculpture. Some of the Shaker materials, originally secured for their historic value, were recognized as having artistic significance as well, and later on leading art museums and artists also recognized their merit.

With the Work Projects Administration assistance the collections of history and art were greatly expanded, particularly the industrial materials and the photographs and architectural drawings of the Shaker culture, which supplemented the original William Winter photographs already in the collection. Finally, the independent donation of the superb Winter "Shaker Portfolio" completed this series.

As these collections expanded it became more and more evident that there was a real need for an upstate public fine arts center, where materials bearing on the history of the fine arts should be preserved, and that at least a representative collection of the fine arts should be assembled and made available to the public.

It has not been customary for the art museums to collect the models, sketches, sketchbooks, photographs and memorabilia of artists. This may be due to the belief that this field belongs to the historic museums or societies, and to the fact that art museums are primarily concerned with the finished work and not with the process of creating art. Sculptors' attics, garages and cellars are often crowded with models, some of which are very worthy of preservation, for at times a model may even be superior to the finished work, just as an inspired sketch may surpass the final product. There should be some public repository where such material of merit could be preserved since it is of great value to students as well as to cultural historians. The State Museum's broad functions make it possible for it to include not only the finished work of artists but also the evidences of their development.

History and art exhibits. Valuable historic collections have been accumulating in the State Museum storerooms for more than a generation, and visitors interested in history have been surprised to learn that the State Museum had a historic collection, because they saw none on exhibition. The installation of even small temporary exhibits aroused interest and evoked requests for more historic exhibits. After the World's Fair in 1940 the Fair Commission and the Budget Director transferred to the State Museum the four David C. Lithgow murals, portraying the history of New York State, and a series of display cases, on condition that a Hall of New York History be installed in the State Museum. With the crust of inertia thus broken, materials were taken from the storerooms, offices and hallways and installed in the wall cases. The Hall of History thus consists of a representative exhibit of small objects from the collections, which are adapted to the shallow wall cases, and a few large objects. The general character of this exhibit has been mentioned elsewhere in this report (p. 19) and is shown in figures 2–17.

The E. L. Henry Exhibit. With the opening of the Hall of New York History, an adjacent hall was available for temporary exhibits, and this made it possible to make a selection from the Stetson-Wells, E. L. Henry Collection of the sketches, sketchbooks, studies and paintings of E. L. Henry N. A., and display them with

various interesting memorabilia (figs. 18-19). The collection had been carefully organized by Elizabeth McCausland in connection with her study of the life and work of Henry, which is to be published as a State Museum bulletin. With the assistance of Wilfred Thomas and Frank M. Thomas this exhibition was installed in September 1942, and is the first definitely fine art exhibit to be made by the State Museum from its own collections.

The Art Collection now contains a few series that are worthy of similar display, such as the William Winter "Shaker Portfolio" photographs, Berenice Abbott's photographs of "Changing New York," a series of Frederick C. Hiron's architectural drawings, the E. L. Mooney N. A. Art Collection, and the architectural drawings of the Shaker buildings at Watervliet and Mount Lebanon.

The latest important addition to the Art Collection consists of two animal bronzes by Anna Hyatt Huntington, which were donated by the artist. One is entitled "Domestic Trouble" of ringtailed monkeys, and the other, "Peacocks Fighting" (figure 20).

The balancing process. The preceding emphasis on education, history and art has not been to discredit or disparage the work of the State Museum in the field of the natural sciences, but rather to call attention to its incompleteness, in the hope that an improved functional balance may ultimately advance all phases of the work of the State Museum by providing a broader and sounder basis in public service and public support.

With inadequate funds for all kinds of work it seemed best to concentrate geological work on quadrangles near Albany and to make the quadrangle reports more generally useful by including not less of the technical details but more that could be used by the average citizen.

An outstanding geological problem in the State is the geology of the Adirondack region. This region is important from several points of view: scientific, educational, recreational, conservational, industrial and economic. With the possible development of cheap electric power from the St Lawrence, northern New York with its mineral wealth would be transformed from a region of marginal agriculture to one of industry. It has therefore not been by accident but by studious deliberation that the geological reports on the quadrangles of the Adirondack region have been pushed for many years as rapidly as possible. The soundness of this policy will probably be revealed within the next generation. Shorter-ranged current problems, such as gas, oil, limestone, gypsum, salt, sand and gravel, have not been neglected.

Probably the weakest point in the above practice has been the relative lack of attention to the broad aspects of public policies regarding the wise use of these resources. Rafter's famous report (1905) on hydrology of the State was in his day an outstanding contribution toward a water resources policy. We need similar, up-to-date, broad policies regarding oil, gas, water and the strategic minerals. It seems rather strange that after more than 100 years of geological work the formulation of public policies has not made more progress.

The unique role which the Geological and Natural History Survey, the ancestor of the New York State Museum, played in the history of American geology has long been recognized. The outstanding geological historian, Dr George P. Merrill, in 1924, stated of this early Survey, "This led to an organization which has left a more lasting impression upon American geology than any that has followed or had preceded it." It has not always been clearly grasped, however, how the geographic position and geological history of the State influenced this unique contribution. It seems to have been because the geological history of New England and of the northern Atlantic seaboard was too incomplete and too complicated to permit the ready determination of the historical sequence. Because of erosion, metamorphism of the rocks, which destroyed the inclosed fossils, and their complicated structure, the age sequence of the Paleozoic formations in these regions could not be readily determined. The geologists of the New York State Survey, working where the fossil records were well preserved, as in the Helderbergs, Catskills and around the borders of the Adirondacks and the Mohawk valley, not only determined the age sequence for this State but for much of eastern North America. For this reason the names of the New York localities, such as Potsdam, Catskill, Beekmantown, Trenton, Salina, Manlius, Esopus, Schoharie, Onondaga, Cayuga, Hamilton and Niagara, have become the common language of geology in America. Since that pioneer work no similar outstanding geological discoveries of equal magnitude have been made. In the meantime the times have changed, and all geological work needs now to be oriented with regard to the present and proximate future. The present prospects point toward a greater emphasis on broad economic public policies. In order to protect public interests in these matters, we shall need superior leaders in order that the public may be made to realize the important role which geology has played and should play in the welfare of the people of this State.

Something of the role that geology has played in the State has been indicated in the preceding remarks. A similar situation exists with

regard to the field of botany in the State Museum. In the past the botanical work has been devoted largely to an inventory of the plants of the State. This involved a large amount of intensive and strenuous work of fundamental importance, and such work is never completed. At the same time it is today also necessary to know the relation of plants to their local environment and to the welfare of man in his broader relations, such as to agriculture, to forestry, to land use and to public land policies. As in other fields, the methods of study have become greatly refined and broadened and botanists have new objectives and a greater sense of public responsibility. Botany must also develop a broad educational approach and reveal the important role which plants play in the life of the modern world.

The special ecological vegetational surveys that have been made, as in the Allegany State Park, in Cattaraugus county and in Monroe county, the floral studies in Columbia county and the general floristic botanical field work elsewhere have all been a part of this general program. There is great need of increasing these ecological vegetational surveys if botanical work is to be able to contribute to public land policies in a practical manner. Plant inventories and floral lists do not go far enough to be utilizable by those engaged in land use problems and similar public policies. Each has its place but the work should not be considered complete until, as has been said, results can be used and coordinated with the needs of forestry, agriculture and other land use policies.

In the field of general zoology the problems often run parallel to those of plant study. The inventories and classifications must first be conducted, but animals are so much more numerous in kinds than plants, and are often more difficult to study, so that the field has been broken up into several special fields.

Attention has been given to inventories, classifications and life histories, to phases of bird behavior, as their songs and habits as revealed by banding, and extensive field studies have been made of their population in various habitats, as a foundation for understanding their relation to land policies and management. Many of the animal problems, like those of plants, will have to be studied on a regional basis before the results can be made available for correlation and integration with other public policies. Generally speaking precedence should be given to problems of immediate public or practical interest. Here also, an educational problem is involved in showing the public the role of animal life in relation to human affairs, and the best methods of conserving and utilizing it.

Entomology has expanded, on the basis of its practical, economic and health relations, until it has become an immense field. This phase of the State Museum work has always been closely related to practical affairs of the garden, field, forest and waters, as well as to health. This has involved intensive field, laboratory and experimental studies under a considerable variety of conditions in the fields and forests. The mosquito control problem became, during the depression, an important public employment relief project. An important advance has also been made in the control of the black fly. In addition to the individual problems concerned with insects, there are many that are best administered as community activities, and thus at once they involve public policy. Many signs of the times indicate that one of the great advances in entomology will be in relating and formulating its work to public policies, such as to health, land use and conservation. Even during the depression and the war, there has been no slackening of the demand for information within this field; indeed, it really increased.

In concluding these remarks on the balancing process, let us recall the varied natural advantages of this State, due to its geographic position, with the finest harbor leading to the interior of the greatest food-producing area in the temperate zone, and within its own borders possessing great physical and biological diversity, including all degrees of conditions from the seashore to the top of Mount Marcy, the ocean, the Great Lakes, brooks, rivers, lakes and ponds, fields, forests and varied mineral wealth. These indicate its great and varied resources in terms of opportunity for important scientific study in relation to public welfare and stress the urgency of a balanced program.

A large, diverse population devoted to agriculture, forestry and a great variety of industries, forms of commerce and finance, constitutes one of the most complex political units in the world. What a field for the application of the methods of science and scholarship to the problems of living under these conditions!

Within this expanding field the State Museum staff should be able to find ample scope for the application of their methods of work. Is it not their opportunity and obligation to investigate and report on the problems that have significant bearing on the welfare of the people?

With all this emphasis on public policy let it be clearly understood that this *begins* first of all with a fairly clear-cut understanding of the functions and policy for the State Museum itself, its role in the Education Department, its relation to other Departments, to other state officials, and finally to the general public.

There are a number of important functions within the field of the State Museum for which the Education Department has no well-defined policies. These need study and clarification, as do also certain state policies, particularly with regard to mineral and biological resources. Policies need to be determined also in regard to the preservation of natural scenic and scientific features, certain historical, industrial, artistic, and other similar important cultural resources, in order that they may be utilized to best advantage. The general public naturally turns to the State Education Department for guidance in such matters and it should not be disappointed.

The postwar period. The preceding discussion, with its emphasis on the functions of the State Museum, its inadequate support and lack of balance, is not intended to belittle in any degree the value of the substantial work already done, but does note its incompleteness, stresses its public interest and its relation to public welfare. Today public support requires a broad foundation and a strong appeal to a large public.

Unless the signs of the times are incorrectly read, the postwar period will be a period of great adjustments, and scientific, educational and cultural agencies will share in this transformation. Some students fear that scientific and cultural agencies will be thrust aside by a wave of technical pressure, but I doubt that this will be more than a temporary stage, because it seems probable that when some of the economic tension and pressure is released there will be an even stronger wave of interest toward scientific, cultural, educational and recreational interests. This is a possibility that should be kept in mind and planned for. There will thus be both the economic and cultural aspect of this transitional period. Much of the work will probably fall to the younger generation who are less influenced by the older ideas and conditions.

In concluding this general review of the work of the State Museum attention should be called to a considerable number of studies and activities which in the aggregate are very important, but which are more or less special, isolated, or incomplete and therefore have not fallen into line with the major current or drift of this summary, such as special taxonomic studies of plants and animals, the various work relief programs, the Allegany School and similar activities and investigations.

It may appear that undue emphasis has been given to public policies. This has been deliberately stressed because of its importance and its relative neglect in the past. Public officials themselves do not always understand the role of research or fact-finding agencies.

It is doubtful that the major role of the State Museum can be properly understood until a comprehensive study is made of the functions of state research and the role of the State Museum in a comprehensive public research program and policy, as has been stressed in these Annual Reports for many years.

In concluding this report I wish to acknowledge the appreciative and generous attitude and cooperation of the public with which the State Museum has worked. This is the source of the greatest personal satisfaction, and the resulting friendly relations are proof of its reality. Of course this public is not organized or vocal, and the public service rendered is often overlooked because of its intangible character, although it often takes very concrete form. It is, however, this kind of response which gives assurance of the need of such a public institution. Much of this is over and above the so-called "practical" assistance given in the form of innumerable items of advice and special information to industries, to teachers and to other individuals. At the same time there is the less personal public service given by the State Museum publications, which are widely distributed in libraries throughout the world.

When all these influences are taken into account, one is able to realize the role and function which the State Museum performs in our economic and social system, within and without the State.

Finally, in concluding the 107th Annual Report I wish to mention an interesting personal item which illustrates how the public scientific institutions give informal educational assistance that is all too frequently overlooked and forgotten.

In 1891, a lad of high school age, who was interested in natural history and was living in a conservative educational community dominated by the classical tradition, read a biographical sketch of the early entomologist Thomas Say, by George Ord, in which Ord urged young persons to delay the fascinating study of natural history until they were established in life, or they risked the prospect of being unable to earn a living, through the neglect of their business!

In struggling for an answer to the general question as to how to make a living and to secure the necessary training for the study of natural history the boy considered other alternatives. He was fortunate, however, in having the addresses of leading naturalists in the handbook of the Agassiz Association, The Three Kingdoms (by President Harlan H. Ballard, a former student of Louis Agassiz) and he wrote requesting advice from some members of the "Council" of the Agassiz Association. These letters were received from President David Starr Jordan of Stanford University, Dean N. S. Shaler of

Harvard University, and from the entomologists Dr Henry C. McCook of Philadelphia and Dr J. A. Lintner, State Entomologist, New York State Museum. This was the first time that I came within the sphere of influence of the State Museum. The letter from Doctor Lintner is as follows:

STATE OF NEW YORK
OFFICE OF THE STATE ENTOMOLOGIST

Albany, April 21, 1891

Mr. C. C. Adams

Dear Sir: In reply to your inquiries of the 16th, just received I would state: The studies that you mention—Latin, Greek, and the mathematics will all be of service to you, as a mental discipline, in your study of Natural History. I would at least devote the time to the classics, that would enable you to understand the construction of the Greek and Latin names employed in classification, and to be able to make out the brief latin generic diagnoses that are frequently given. Such a knowledge of French and German as would enable you to read these languages would be of service to you in advanced studies. I do not read the German, and I have frequently to deplore my being shut out from many publications that would aid me materially.

Very truly yours

(*Signed*) J. A. Lintner

Botany will also be of much use, in your study of food-plants, "Entomology and botany" are frequently combined in our Agricul. Experiment Stations.

Two years later at the World's Fair at Chicago (1893) the fungus exhibit of the New York State Museum, by the State Botanist, Dr Charles H. Peck, enabled me to identify a number of fleshy fungi from which I had collected interesting insects.

Ever since these early days the New York State Museum has been for me an important and valued source of practical scientific and educational information. With the passing of the years there must have been thousands of similar instances unrecorded. This makes a fitting termination of my official relation to the New York State Museum, but not of course of my continued interest in it as a scientific, cultural and educational institution.

ANNUAL BIBLIOGRAPHY OF THE STATE MUSEUM

Publications by the Museum staff for the fiscal year ending March 31, 1943, or based, at least in part, on the Museum collections, or made in cooperation with the State Museum, are as follows:

Adams, Charles C.

1943 One Hundred Fifth Annual Report of the New York State Museum. N. Y. State Museum Bul. 333:1–92

Bathurst, Effie G.

1943 Wild Flowers in Our Woods. How to build a nature trail. In Phonograph Records as an Aid to Learning. Univ. State of New York. The State Education Dep't. p. 109–16

Clausen, Robert T.

1943 Studies in the *Ophroglossaceae: Botrychium,* subgenus *Sceptridicum.* Amer. Fern Jour., 33, no. 1:11–27

Goldring, Winifred

1942 Restudy of the Schoharie and Esopus Formations in New York State. Amer. Jour. Sci., 240:673–94

—— Geology of the Coxsackie Quadrangle (In press)

Hartnagel, C. A.

1942 Oil and Gas Developments in New York During 1941. Trans. Amer. Inst. Min. and Met. Engrs., 146:371–73

1942*a* Oil and Gas Activities in New York–1941. Nat. Oil Scouts and Landmen's Ass'n Year Book—1941, 12:390–96

Hosmer, Ralph S.

1943 James S. Whipple, Forest Administrator. Univ. State of New York Bul. to the Schools, 29, no. 7:252–54

Houghton, Frederick

1943 Sanctuaries for Wild Plants. Univ. State of New York Bul. to the Schools, 29, no. 7:247–52

House, H. D.

1942 Clarence J. Elting and his Herbarium. Torreya, v. 42, no. 6:181–90

Koster, L. J.

1942 Sora, Near-Victim of a Fish. Science, 96:580–81. [With Dayton Stoner]. Science, 96:580–81

Newland, D. H.

1942 Guide to the Geology of the Lake George Region. N. Y. State Mus. Hdbk 19 (In press)

Ruedemann, Rudolf

—— Geology of the Catskill-Kaaterskill Quadrangles, *Part 1.* Cambrian and Ordovician Geology of the Catskill Quadrangle (In press)

Stoner, Dayton

1942 Longevity and Other Data on a Captive English Sparrow. Auk, 59:440–42

1942*a* Behavior of Young Bank Swallows. After First Leaving the Nest. Bird-Banding, 13:107–10

1942*b* Bird Study through Banding. Scientific Monthly, 55:132–38

1942*c* The 1942 Status of the Normandin Woods Heronry. Feathers, 4:57–58

1942*d* A Seven-Year-Old Bank Swallow. Science, 96:273–74. [With L. C. Stoner]

1942*e* European Starling Nesting in a Bank Swallow Burrow. Wilson Bulletin, 54:215

1942*f* Aspergillosis in a Snowy Owl. Auk, 59:577–78. [With Gordon M. Meade]

1942*g* Author's Summary of his "Behavior of Young Bank Swallows after First Leaving the Nest." [Bird-Banding, 13:107–10, 1942] Biological Abstracts, 16:2124–25

1942*h* Sora, Near-Victim of a Fish. Science, 96:580–81. [With L. J. Koster]

1943 Defensive Behavior of the White-breasted Nuthatch. Auk, 60:95–96

1943*a* Bird Records for Eastern New York. Feathers, 5:9–14

1943*b* Yellow-bellied Sapsucker, Tree-troubler. Univ. State of N. Y. Bul. to the Schools, 29, no. 7:266–70

White, W. L.

1942 Studies in the Genus *Helotium.* I. A Review of the Species Described by Peck. Mycologia, 34:154–79

MUSEUM ACCESSIONS FOR THE YEAR

Accessions are new additions to the Museum. These are classified into the following groups:

1 By donation: objects presented to the Museum
2 By exchange: for other Museum materials etc.
3 By purchase: payments from the Museum budget
4 By the staff: collected by the staff during official duties of any kind
5 By transfer: from other state departments or other divisions of the State Government, as provided by law

Gifts to scientific and educational institutions are listed at the end of this section.

BY DONATION

Ackerman, Violet, New York, N. Y.
Specimens of bark-louse (*Ceratipsocus venosus* Kolbe) New York, N. Y.

Adler, Margaret, St Huberts, N. Y.
Twig of balsam fir with staminate cones. St Huberts, N. Y.

Albany Institute of History and Art (through John Davis Hatch) Albany, N. Y.
Horn spoon

Allen, A. F., Albany, N. Y.
3 two-lined salamanders, Lake View House, Dutchess county, N. Y.

Anderson, Mrs R. F., Waterford, N. Y.
Specimens of black carpet beetle larvae. Waterford, N. Y.

Archibald, Mrs Helen G., Albany, N. Y.
Specimens of household insects, Albany, N. Y.

Arnold, E. J., Albany, N. Y.
Old wooden potato masher
Old adz

Avery, Thurman J., Albany, N. Y.
Specimens of "walking-stick" insects, Altamont, N. Y.

Bartlett, Guy, Schenectady, N. Y.
Black and white warbler, Schenectady, N. Y.

Belknap, Mrs B. H., Delmar, N. Y.
Skull of cedar waxwing, New Salem, N. Y.

Billstone, Victor, Jamestown, N. Y.
Crude oil from shallow well 2 miles northeast of Frewsburg, N. Y.
Crude petroleum (thin black) from shallow wells 2½ miles south of Frewsburg, N. Y.

Blank, Walter, Poughkeepsie, N. Y.
Specimens of weevils, *Brachyrhinus ovatus* L., Tupper Lake, N. Y.
Specimens of box elder plant bug, *Leptocoris trivittatus* Say, Fishkill, N. Y.
Specimens of powder post beetles, Cohoes, N. Y.
Specimens of psocids, *Lachesilla pedicularia* L., Lake George, N. Y.

Blust, Mrs Raymond, Sherrill, N. Y.
Specimens of dog fleas, Sherrill, N. Y.

Bly, Mrs Ivy, Montgomery, N. Y.
Specimens of elm leaf beetles, Montgomery, N. Y.

Bond, Peter, Albany, N. Y.
Skull of robin, Albany, N. Y.

Bono, Peter, Albany, N. Y.
Olive-backed thrush, Albany, N. Y.

Bouton, Mrs Estelle Wright, Cragsmoor, N. Y.
Photographs and negatives from vicinity of Cragsmoor, N. Y., of E. L. Henry's art

Briggs, Roy, Duane Stage Route, Malone, N. Y.
2 specimens of magnetite from Studley Hill near Malone, N. Y.

Brockett, Frank S., Cambridge, N. Y.
Large wooden hay fork

Brooks, Dr P. B., Albany, N. Y.
Specimen of camel cricket, Altamont, N. Y.

Buckholz, Dr A. B., Albany, N. Y.
Specimens of brown dog tick, Albany, N. Y.

Buffalo Museum of Sciences (through Dr Irving G. Reimann), Buffalo, N. Y.
Photograph of a restoration of the trilobite *Terataspis*
2 photographs of a restoration of the cephalopod *Goldringia*

Buxton, Mary D., and Husson, C. Julie, Cragsmoor, N. Y.
Painting by E. L. Henry
Print of George Washington riding through the streets of New York

Clymer, Virgil H., Syracuse, N. Y.
Colored composite picture of Howe Caverns, N. Y.
Stafford scenic plate of Howe Caverns, N. Y.

Cohan, Timothy, Albany, N. Y.
Specimens of immature chinch bugs, Albany, N. Y.

Cohen, Ernest A. R., Schenectady, N. Y.
Specimens of black carpet beetles, Schenectady, N. Y.

Collister, Morton C., Baldwin, N. Y.
Old banner of New York State Academic Principals Association

Crockett, Dr R. L., Oneida, N. Y.
27 specimens of plants from New York State

Culp, Mrs H. E., Albany, N. Y.
Specimens (larvae) of webbing clothes moth, Albany, N. Y.

Cummings, Mrs H. W., Albany, N. Y.
Specimens of carpenter ants, Albany, N. Y.

Cummings, Rev. E. J., Schenectady, N. Y.
7 specimens of plants from Schenectady county

Deats, William, Barryville, N. Y.
8 fossil plant specimens near Pond Eddy, vicinity of Barryville and between Barryville and Port Jervis, N. Y.

Dickinson, G. S., Poughkeepsie, N. Y.
Specimens of shed-building ants, Poughkeepsie, N. Y.

Dietrich, Dr Henry, Ithaca, N. Y.
Specimens of click beetles, *Ludius appressus* Rand., Mt Marcy, N. Y.

Eaton, Mrs A. H., Baldwin, Long Island, N. Y.
Specimens of saw-toothed grain beetles, Baldwin, L. I., N. Y.

Elting, Mrs Clarence J., Highland, N. Y.
1072 specimens of plants, mostly from Ulster county, N. Y.
3 old metal buckles
2 hand wrought nails
4 pitted stones; 2 pestles; netsinker; gorget fragment, bannerstone fragment; 3 drills; 5 drill fragments; 115 arrowpoints; 10 knives; 3 blades; 26 blanks and rejects; 4 scrapers; 4 quarts miscellaneous chipped fragments; 52 damaged arrowpoints; 2 flint lock flints from near Highland, N. Y.
5 arrowpoints and potsherd from New York State localities
8 arrowpoints from various U. S. localities

Fayerweather, Mrs Charles, New Lebanon, N. Y.
Iron stand
Shaker doll's bonnet block
Small Shaker stool
Fireplace equipment
Old map of Monroe county, 1858

Fleming, John L., Troy, N. Y.
Specimens of pavement or lawn ants, Troy, N. Y.

Follett, Louis E., Saratoga Springs, N. Y.
Half bannerstone with two perforations; 2 scrapers; abraiding stone; spearhead part; gorget fragment with one perforation; small drill; damaged celt, from vicinity of Fish Creek, N. Y.

Frederick, A. C., Albany, N. Y.
Specimens of whirligig beetles, *Gyrinus dubius* Wallis, Mt Albert, Quebec, Canada

Gardner, Mrs Harriet L., Newburgh, N. Y.
Antiques from the Cosman-Gardner home at Newburgh, N. Y.

Garry, Thomas, Albany, N. Y.
Specimen of "walking-stick," Delmar, N. Y.

Gilcreas, F. W., Albany, N. Y.
Specimens of snow fleas, Horseheads, N. Y.

Glasgow, Dr Hugh, Geneva, N. Y.
Specimens of scarab beetles, *Amphimallon majalis* Rasoum, Newark, N. Y.

Glens Falls Insurance Company, Glens Falls, N. Y.
Colored print (kotsbackrome) of Black Watch at Ticonderoga, July 8, 1758. Painting by J. L. G. Ferris

Goldring, Mrs Frederick, sr, and Dr Winifred, Slingerlands, N. Y.
Oil painting of a goat by Van Zandt

Gosling, Mrs J. W., 1084 Waverley pl., Schenectady, N. Y.
Indian sundial by J. W. Gosling

Grant, David, Troy, N. Y.
2 advertising cards of Button Engine Works, 1868

Griffin, Dr C. A., Albany, N. Y.
Specimens of parasitic mites from rabbits, Albany, N. Y.

Grossbeck, William, Hornell, N. Y.
Specimens of flesh-fly larvae, Steuben county, N. Y.

Halley, Mrs Ernest, Watertown, N. Y.
Specimen of pentatomid bug, *Perillus bioculatus* Fab., Watertown, N. Y.

Hallinan, F. J., Albany, N. Y.
Specimens of bird lice, Albany, N. Y.

Hampton, John M. jr, Loudonville, N. Y.
Specimens of varied carpet beetle larvae, Loudonville, N. Y.

Hannan, William E., Albany, N. Y.
Specimen of ichneumon fly, Albany, N. Y.

Harpham, C. L., Loudonville, N. Y.
Virginia opossum, Loudonville, N. Y.

Haskins, Vernon, East Durham, N. Y.
Sora, East Durham, N. Y.

Hayner, Warren, Albany, N. Y.
Specimens of lady beetles, *Chilocorus bivulneris,* West Sand Lake, N. Y.

Hennessy, Harry, Albany, N. Y.
Starling, Albany, N. Y.

Hill, Dudley Toll, Scotia, N. Y.
Old photographs and prints

Hollister, J. M., Schenectady, N. Y.
Specimen of sphinx moth, Stowe, Vt.
Kodachrome photograph of tent caterpillar egg mass, Schenectady, N. Y.
Specimens of spider wasp and sheet web-weaver spider
Specimens of walking-stick insects, Schenectady, N. Y.

Huntington, Mrs Archer M., Bethel, Conn.
2 bronze statues "Domestic Trouble" and "Peacocks Fighting"

Ibbott, William B., Wilson, Carl, and Howard, John, South Cambridge, N. Y.
Body of snowy owl with aspergillotic infection. South Cambridge, N. Y.

Ingraham, Donald, Cambridge, N. Y.
2 old coffee mills

Johnson, Clarence, Schenectady, N. Y.
Specimens of egg mass and newly hatched spiders

Kay, Dr G. Marshall, New York, N. Y.
11 graptolites from various formations and localities

Kellert, Dr Ellis, Schenectady, N. Y.
Specimens of tropical rat mites, Schenectady, N. Y.

Kellogg Switchboard and Supply Company, Chicago, Ill.
McCulloch radio tube

Kemp, Mrs R. C., Albany, N. Y.
Canary, Albany, N. Y.

Kennedy, J. D., Cortland, N. Y.
4 specimens of *Hypericum prolificum* from Cortland county, N. Y.

Killian, E. J., Albany, N. Y.
Specimens of weevils, *Calomycterus setarius* Roelofs, Albany, N. Y.

Kirker, J. E., Albany, N. Y.
Specimen of flea, Albany, N. Y.

Koster, John, West Nyack, N. Y.
7 gray squirrels; 5 skulls of birds and small mammals; 2 red squirrels; 3 starlings and Virginia opossum, West Nyack, N. Y.

Kraft, Fred G., Cragsmoor, N. Y.
Memorabilia of Artist E. L. Henry
Photograph of a E. L. Henry painting
Plaster bust of Henry P. Avery

Kruger, F. F., Schenectady, N. Y.
Specimen of flea, Schenectady, N. Y.

Langdon, Brig. Gen. Russell C., Brooklyn, N. Y.
17 arrowpoints from western North Carolina
Piece of coquina from Old Spanish Fort at Matanzas, Fla.
Lamellibranch shells and sharks teeth, Moorehead City, N. C.
Civil War, Spanish American War material and memorabilia of Colonel Loomis L. Langdon and Brigadier General Russell L. Langdon

Laporte, A. A., New York, N. Y.
Specimens of ants, New Rochelle, N. Y.

Lecoste, Madame, Outremont, Quebec, Canada
Photograph and book of Mrs D. A. Graves
Pencil drawing of Antonia Madina, by William Wolcott
Shakesperian Reader

Legenbauer, George, Voorheesville, N. Y.
Specimen of broad-necked Prionus, Voorheesville, N. Y.

Leon, M. W., Binghamton, N. Y.
Specimens of larvae of varied carpet beetle, Binghamton, N. Y.

Linindoll, Harry, Albany, N. Y.
Specimens of sap beetles, *Carpophilus hemipterus* L., Albany, N. Y.

Liscomb, Orlando P., Fort Orange Club, Albany, N. Y.
Medal commemorating opening of Erie Canal, 1826

Lithgow, David C., (through Wilfred Thomas), Albany, N. Y.
3 designs by David C. Lithgow
Portrait of man by David C. Lithgow
2 study drawings by David C. Lithgow
Oil study of a woman by David C. Lithgow
Oil paintings of a former Mayor of Albany by William Page
Portrait of a woman by William Barkintine

Little, Miss Edith, Menands, N. Y.
Specimens of termites, Menands, N. Y.

Littlefield, E. W., Delmar, N. Y.
Specimen of dytiscid beetle, *Dytiscus harrisi* Kby., Malone, N. Y.

Lowenthal, Esther, Keene Valley, N. Y.
Specimens of pine leaf aphids, pine needle scale, and larvae of LeConte's sawfly, Keene Valley, N. Y.

Martens, Agnes D., New Russia, N. Y.
Specimen of *Amorpha fruticosa,* Essex county, N. Y.

Matthews, W. A., Rochester, N. Y.
55 specimens of plants from western New York

Mayer, N. H., Canaan, N. Y.
Specimen of carpenter ant, Canaan, N. Y.

McKelvey, Robert, Saratoga Springs, N. Y.
Specimen of caddis fly case, Saratoga Springs, N. Y.

Mead, Esther, Sherburne, N. Y.
Snowy owl, Sherburne, N. Y.

Mein, John, New City, N. Y.
Red squirrel, New City, N. Y.
Cottontail rabbit, West Nyack, N. Y.

Miltz, Dr Murray, Brooklyn, N. Y.
Specimens of ants, Brooklyn, N. Y.

Mitchell, E. W., Schenectady, N. Y.
Specimens of larvae of varied carpet beetle

Moore, Elizabeth H., Hants, England
Memorabilia of C. H. Moore

Myers, W. L., Albany, N. Y.
Specimens of pine bark aphids

National Lead Co., Tahawus, N. Y.
7 specimens of titaniferous magnetite from Lake Sanford, N. Y.
25 specimens of anorthosite from Lake Sanford, N. Y.

Oneida Community, Oneida, N. Y.
1575 specimens of plants from the United States

Paladin, Arthur, Albany, N. Y.
3 owl flies from great horned owl, Valatie, N. Y.
Starling, Mexico, N. Y.
Skull of gray fox, Selkirk, N. Y.
3 skulls of black bears, Fulton county, Tupper Lake and Herkimer, N. Y.

Paradis, E. M., Albany, N. Y.
Specimens of brown dog ticks, Albany, N. Y.

Parker, Orissa V., Hoosick Falls, N. Y.
Specimen of gall on raspberry, Hoosick Falls, N. Y.

Partridge, Miss C. B., Menands, N. Y.
Specimens of lawn ants, Menands, N. Y.

Pauly, K. A., Schenectady, N. Y.
Thin section slide of fossil wood from Arizona
5 thin section slides of fossil wood from Thedford, Ont., Canada

Peters, Charles, Cragsmoor, N. Y.
Collection of E. L. Henry art material

Pittman, Mrs C. F., Schenectady, N. Y.
Specimens of larvae of varied carpet beetle, Schenectady, N. Y.

Platania, Mrs Ann, Albany, N. Y.
Specimen of clothes moth, Albany, N. Y.

Rea, Dr Paul M., Santa Barbara, Calif.
Specimen of *Lepiota Glatfelteri* Peck, from California

Reoux, Mrs Adelia H., and Henry A., Warrensburg, N. Y.
The Albert H. Thomas Collection of guns, revolvers, swords etc.

Riemer, A. C., Delmar, N. Y.
Specimen of dog tick, Delmar, N. Y.

Rock, Mrs G. A., Whitehall, N. Y.
Specimens of larder beetle larvae, Whitehall, N. Y.

Rose, Lewis N., San Francisco, Calif.
24 specimens of plants from California

Rowe, Mrs Gertrude, Round Lake, N. Y.
Western fox squirrel (melano)

Rowley, Elmer B., Glens Falls, N. Y.
Samarskite-Aeschynite with black tourmaline in feldspar from Overlook Quarry near Conklingville, N. Y.
Cyrtolite crystals with Samarskite-Aeschynite from Overlook Quarry near Conklingville, N. Y.

Ruedemann, Rudolf, Albany, N. Y.
2 graptolites from near Jamesville, N. Y.

Sampson, Dr J. A., Albany, N. Y.
American redstart, Albany, N. Y.

Sanderson, W. E., Loudonville, N. Y.
Eastern turkey, immature, Loudonville, N. Y.

Sanford, Mrs Rollin B., Albany, N. Y.
Specimen of *Eupatorium coelestinum,* Newtonville, N. Y.

Schreiber, Rev. G. L., Kingston, N. Y.
10 specimens of plants from the Hudson valley, N. Y.

Shephard, Estate of Mr and Mrs Finley (through C. C. Huitt, executor), New York, N. Y.
Shovel from Saratoga Battlefield, 1777
Celt from western New York

Shillinglaw, James McC., Westmere, N. Y.
Specimen of cicada killer, Westmere, N. Y.

Simons, Howard, Albany, N. Y.
Book, "Field Service Regulation" U. S. Army, 1914
10-dollar bill of Confederate currency
World War badge of Albany War Chest, 1918

Smith, Vera, Troy, N. Y.
Nest of Baltimore oriole, Defreestville, N. Y.

Solheim, Dr W. G., Laramie, Wyo.
5 specimens of fungi from Wyoming

Spath, Mrs F. J., Albany, N. Y.
Specimens of ground beetle *(Harpalus)*, Albany, N. Y.

Spiker, C. J., Branchport, N. Y.
Bicknell's thrush, Branchport, N. Y.

Staats, Mrs Esther F., Rensselaer, N. Y.
Old buckskin breeches

Starr, Nellie M., Delmar, N. Y.
Buffalo hide overcoat

Stone, Harry, New York, N. Y.
2 early nonelectric telephones

Stoneman, William H., Albany, N. Y.
69 articles of sailmaker's tools and equipment
Old sword-cane combination
2 historical lead pencils
Lithograph of Abraham Lincoln by Currier and Ives
Lithograph of President Andrew Jackson by Currier and Ives
Early lithograph of Woman and Child by Harry E. Pease
Lithograph of Barnum's Gallery of Wonders
Carved cigar holder
Materials relating to the history of navigation

Swane, Mrs Hubert E., Waverly, N. Y.
2 Quaker bonnets

Thomas, Frank M., Albany, N. Y.
Pamphlets on history and art
2 small water colors
Catalogue of George West Museum 1890
Papers on Stephen C. Foster
Old apothecary weighing scales

Thomas, Wilfred, Albany, N. Y.
Civil War explosive shrapnel
Toy Civil War sabre
Artist Thomas Cole's pallette
Oil painting of a bootblack by W. B. Sparks
Brass Civil War buckle

Thompson, Deaconess Amy G., and Rev. Paul S. Huntington, Upper Red Hook, N. Y.
Memorabilia of artist E. L. Mooney

Tucker, Gilbert N., Glenmont, N. Y.
Specimens of Mexican bean beetle larvae, Glenmont, N. Y.

Vail, Robert W. G., Albany, N. Y.
Medal commemorating passage of prohibition amendment 18

Van Amringe, Mrs Edith H., New York, N. Y.
Addition to the Frederick C. Hirons Architectural Collection

Van Derzee, Mrs Albany, N. Y.
Specimen of brown dog tick, Albany, N. Y.

Van Etten, Dr E. J., Saugerties, N. Y.
3 specimens of *Blephilia hirsuta* (Pursh) Benth., from Ulster county, N. Y.

Van Sanford, Frances A., Albany, N. Y.
Specimen of Indian meal moth, Albany, N. Y.

Wallace, Floyd, Oneonta, N. Y.
Bone awl; 2 hammerstones; 9 miscellaneous arrowpoints from Otsego, N. Y.

Ward, Norman F., Watertown, N. Y.
Specimens of weevils, *Brachyrhinus ovatus* L., Watertown, N. Y.
Specimens of springtails, Watertown, N. Y.

Weeks, Mrs Walter N., Whitehall, N. Y.
Old fan
Old Grebe radio set

Wells, Sister Jennie, North Family of Shakers, Mt Lebanon, N. Y.
Shaker record book of the Sodus Bay Family of Shakers
Shaker book of deaths among the Shakers—1780–1830
Record book of the Sodus Bay Family of Shakers—1834–38

Wilckes, Mrs F., Katonah, N. Y.
Specimens of powder post beetles, Katonah, N. Y.

Wills, Dr J. G., Delmar, N. Y.
Specimens of weevils, *Brachyrhinus ovatus* L., Delmar, N. Y.

Wilson, Marion, Albany, N. Y.
Specimen of dragon fly, Albany, N. Y.

Wood, Bessie, Albany, N. Y.
Oven-bird, Voorheesville, N. Y.

Yerick, Mrs John F., Philmont, N. Y.
Specimens of psocids, *Lachesilla pedicularia* L., Philmont, N. Y.

Zeh, K. Harry, Haverstraw, N. Y.
Specimen of dog flea, Haverstraw, N. Y.

BY EXCHANGE

Schmidt, Robert, Callicoon Center, N. Y.
Mammoth tooth at Schuler's Lake near Callicoon Center, N. Y.

BY PURCHASE

American Meteorite Laboratory, Denver, Colo.
End section of meteorite from Burlington, N. Y.
Slice of meteorite from South Byron, N. Y.

Annesley & Company, Albany, N. Y.
Print, "Brunswick Church" from painting of E. L. Henry
Print, "First Railroad Train" by E. L. Henry

Arnold, E. T., Albany, N. Y.
Brass candle sconces

Congdon, Charles E., Salamanca, N. Y.
4 braided strips of corn from the Cattaraugus Indian reservation

Lecoste, Madame Paul, Outremont, Quebec, Canada
Miniature of Mrs D. A. Graves
Collection of costumes and accessories, *circa* 1835
Painting of Antonia Madina

Richards, Horace G., Philadelphia, Pa.
A 180-card catalog of Pleistocene mollusks

Thomas, Frank M., Albany, N. Y.
A funeral sermon on the death of Abraham Eights
Electric telegraphic code apparatus
Old foot stool
Old banjo
Blood letting lancet
Physician's scale balance
Bone saw
Electric shock machine
Pocket medical dissecting set
2 pestles
Old Kellogg phone
Papers of Victor G. Audubon
Statuette of Rogers group by Daniel Chester French
Collection of old medical materials from home of Hiram Moses, M.D., Petersburg, N. Y., who was graduated from Yale University about 1824

Thomas, Wilfred, Albany, N. Y.
Old iron marine clock
Oil painting by G. H. Broughton
Old electric apparatus

Weil, Margaret, Albany, N. Y.
Surveyor's alidade

BY MUSEUM STAFF

Adams, Dr Charles C., Albany, N. Y.
Specimens of ants, North Elba, N. Y.
Specimen of Japanese beetle, Albany, N. Y.
Specimens of adults and work of alder leaf beetle, North Elba, N. Y.

Broughton, Dr John G., Albany, N. Y.
4 specimens of graphite from Ramapo township, Rockland county, N. Y.
Specimen of phlogopite from Lake Mombasha, Orange county, N. Y.
3 specimens of soapstone from Shenandoah talc mine in East Fishkill township, Dutchess county, N. Y.

Casey, J. L., Albany, N. Y.
Skull of starling, Albany, N. Y.

Chamberlain, K. F., Slingerlands, N. Y.
Specimens of hydrophilid beetles, *Hydrobaticus normatus* Lec.; Haliplid beetles, *Peltodytes simplex* Lec.; dytiscid beetles, *Hydroporus striatellus* Lec.; dytiscid beetles, *Laccophilus decipiens* Lec.; dytiscid beetles, *Laccophilus fasciatus* Aube.; hydrophilid beetles, *Tropisternus californicus* Lec., and *Tropisternus ellipticus* Lec., from Riverside, Calif.
Specimen of longicorn beetle, *Centrodera nevadica* Lec., Sequoia Park, Calif.
Specimens of long-toed water beetles, *Macronychus glabratus* Say, Cornwall, Conn.
Specimen of haliplid beetle, *Haliplus blanchardi* Rbts., Natick, Mass.

Flower, Dr R. H., Cincinnati, Ohio
29 cephalopod specimens, West Brook, N. Y.
21 cephalopod specimens, Borodino, N. Y.
Cephalopod specimen, Georgetown, N. Y.
2 cephalopod specimens, Cayuga Lake, N. Y.
Collection of approximately 97 types and specimens of cephalopods from various localities and formations, as a permanent loan

Glasgow, Dr R. D., Albany, N. Y.
Specimens of chermid galls on hackberry, Morristown, N. J.
Many specimens of black fly adults, eggs, larvae and pupae from Ray Brook, North Elba, Lake Placid, North Creek, Clarksville, Thacher Park and Altamont

Hartnagel, C. A., Albany, N. Y.
4 specimens of magnetite from Clifton mines in St Lawrence county, N. Y.
5 specimens of titaniferous iron ore from Lake Sanford, N. Y.

House, Dr H. D., Albany, N. Y.
Specimens of sumac aphids, Saratoga Lake, N. Y.
Specimen of sphecoid wasp, Loudonville, N. Y.
Specimens of balsam gall midge galls, Tahawus, N. Y.
Specimens of tree hoppers (*Pubilis concava* Say), Queensbury, N. Y.
Black-billed cuckoo, Malta, N. Y.
White-footed mouse, Loudonville, N. Y.

Koster, Louis J., Albany, N. Y.
16 skulls of small mammals, Rockland county, N. Y., and other localities
Skeleton of great blue heron, West Nyack, N. Y.
Starling, Albany, N. Y.

Schoonmaker, W. J., Albany, N. Y.
2 short-tailed shrews, Rensselaer county, N. Y.
2 white-footed mice, Rensselaer county, N. Y.
Red-backed mouse, Rensselaer county, N. Y.
Jumping mouse, Rensselaer county, N. Y.
Skull of short-tailed shrew, Rensselaer county, N. Y.
Skull of red-backed mouse, Rensselaer county, N. Y.
Eastern red-tail, Rensselaer county, N. Y.

Stoner, Dayton, N. Y.
6 lots of fleas from snowy owls, West Albany, N. Y.; Schoharie county, N. Y., and Voorheesville, N. Y.; Ticonderoga, N. Y.; East Schodack, N. Y., and South Cambridge, N. Y.
Starling, Albany, N. Y.
4 bank swallows, Vienna, N. Y.
3 barn swallows, Voorheesville, N. Y.
5 cliff swallows, Troy, N. Y.; Sylvan Beach, N. Y., and Altamont, N. Y.
Eastern song sparrow, Voorheesville, N. Y.
Lot of fleas from bank swallow, Oneida Lake, N. Y.
Skull of muskrat, Guilderland Center, N. Y.
House centipede, Albany, N. Y.
Northern gray squirrel, Albany, N. Y.

Whitney, A. G., Albany, N. Y.
Specimens of fungus beetles (*Lycoperdina ferruginea*), Albany, N. Y.
Specimen of plume moth, Albany, N. Y.
Specimen of parasite wasp (*Pelecinus*), Mt Rafinesque, N. Y.

BY TRANSFER

New York State Historical Collection (through C. C. Adams), Albany, N. Y.
54 miscellaneous chipped implements; 20 miscellaneous chipped points from the Harriet E. Lutman Collection (see 24th Report of Director, p. 37)

New York State Library, Albany, N. Y.
Old thread
Physician's medicine case
Cockade

Superintendent's Office, Education Building, Albany, N. Y.
2 old keys

GIFTS TO INSTITUTIONS AND INDIVIDUALS

Baudisch, Dr Oskar, Saratoga Springs, N. Y.
6 samples of Schenectady shale

Marlitt, Eleanor, Johnstown, N. Y.
15 specimens of rocks and minerals

Norvell, Stevens T. sr, Western Springs, Ill.
Specimen of Clinton iron ore

St Mary's Girls' High School (through Miss Pat Clemens), Phoenix, Ariz.
15 specimens of rocks and minerals

Swartz, Dr Frank M., State College, Pa.
Rubber mold of *Odontochile phacoptyx* var. *gaspensis*

INDEX

Contributions

to the

Flora of Central New York—I

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CONTRIBUTIONS TO THE FLORA OF CENTRAL NEW YORK

By Stanley Jay Smith

INTRODUCTION

This paper deals with new, rare or otherwise interesting elements in the flora of central New York, here defined as that area formed by the combined drainages of the upper Susquehanna and Oswego rivers, thus including all or parts of Lewis, Oneida, Oswego, Madison, Onondaga, Cayuga, Seneca, Wayne, Herkimer, Schoharie, Otsego, Chenango, Delaware, Broome, Cortland, Tompkins, Tioga, Chemung, Schuyler, Steuben, Allegany, Yates and Ontario counties.

A report on the plants from this range has seemed important from various standpoints. The Flora of the Upper Susquehanna has been without revision since 1901, except for some local and special reports. The flora of the Finger lakes has never been studied as a complete unit. Moreover, the two areas have a close geological connection since those lakes are held to occupy preglacial river-valleys once draining the present Susquehanna region into a northern sea. A comparative study of the two systems, giving due attention to the relationship between the plants and this geological history, is desirable. This paper records some of the distributional data on which such a study must be based.

The writer has had some opportunity to collect throughout this area and to examine specimens at various public and private herbaria in connection with this report. Local floras and floristic papers with definite bearing, and in pertinent cases revisional and monographic treatments, have been consulted. The nomenclature used in recent revisions is followed, where the conclusions seem warranted; correlations with names used by House (62) and by Wiegand and Eames (111) are made, including references to papers discussing each change (other than those necessitated to avoid tautonymy or those due to academic questions as to generic limits, where these two works differ). In the case of a plant not included in the usual manuals, citation is made to a work which will furnish means of identification.

The writer wishes to express appreciation for aid and encouragement to K. M. Wiegand, W. C. Muenscher, R. T. Clausen, Mrs M. W. Allen and the other taxonomists of the Cornell University Department of Botany; to H. D. House, State Botanist, of the New York State Museum, and to the curators or owners of the various other herbariums listed below.

Stanley Jay Smith

Madison Barracks, N. Y.
January 31, 1942

ABBREVIATIONS OF HERBARIUM NAMES

(A) State Museum Herbarium, Albany, N. Y.

(B) Bailey Hortorium, Cornell University, Ithaca, N. Y.

(Bk) Brooklyn Botanic Garden Herbarium, Brooklyn Botanic Garden, Brooklyn, N. Y.

(Bu) Clinton Herbarium, Buffalo Academy of Natural Sciences, Buffalo, N. Y.

(Cl) Herbarium of G. D. Cornell, Campbell, N. Y.

(Cn) Herbarium of J. Cohn, New York, N. Y.

(E) Elmira College Herbarium, Elmira College, Elmira, N. Y.

(G) Gray Herbarium, Harvard University, Cambridge, Mass.

(S) College of Liberal Arts and Sciences Herbarium, Syracuse University, Syracuse, N. Y.

(T) Herbarium of C. A. Taylor jr, Ithaca, N. Y.

Specimens are in the Herbarium of the New York State College of Agriculture, Cornell University, Ithaca, unless otherwise noted; in many cases, only one station from a county is represented by mounted material, the others by collections in exchange sets.

ABBREVIATIONS OF COLLECTORS' NAMES

A	C. M. Atwood
Al	Mrs M. W. Allen
B	L. H. Bailey
C	R. T. Clausen
Cu	O. F. Curtis jr
D	Miss S. C. Dyal
E	A. J. Eames
H	H. D. House
L	T. F. Lucy
MacD	E. A. MacDaniels
M	W. C. Muenscher
S	S. J. Smith
W	K. M. Wiegand
W & W	Professor and Mrs K. M. Wiegand
Wr	A. H. Wright
Wr & Wr	Professor and Mrs A. H. Wright

* Observed by the writer.

I THE PERSISTENCE AND ESTABLISHMENT OF CULTIVATED TYPES

. Cultivated plants frequently escape locally, or persist, and often become integral members of the spontaneous flora. Notes on such establishment are far too few. Many times specimens are not even collected on the theory that such types are transient and thus of little interest, despite the fact that some of our worst weeds were once introduced as garden subjects. No cultivated forms are here reported, however, unless there are definite indications either of *bona fide* entrance into the noncultivated flora or of recurrent appearance as a temporary escape.

Picea Abies (L.) Karst. New. TOMPKINS: young trees, 1–22 ft high, at s. end of Slaterville Sw.*, seeded from some large old trees at a near-by farmhouse, the largest already bearing cones; a few plants observed by Meunscher in a cemetery on the Bostwick road n. of upper Enfield glen; CHEMUNG: a few young trees in Gee Sw., Van Etten*, seeded from old trees at a near-by residence; 1 small tree in a wet hollow, Austin hill*; small trees about Breesport*, seeded from ornamental plantings, not doing well in the dry soil. Otherwise not reported as established.

Butomus umbellatus L. (74) Spreading from introduction. TOMPKINS: thousands of plants actively propagating themselves in low marshy ground and on an island along the Cayuga inlet near the fairgrounds, *M & W. T. Winne 20308* (1941—introduced in 1932; at the same time introduced in several places on the Ithaca flats near the head of Cayuga L., where apparently holding its own.) The first-mentioned colony may well give rise to others about the central New York marshlands. Also known in N. Y. about the s. end of L. Champlain (79). In N. A., not known outside of the greater St Lawrence drainage, whence previously reported from the vicinity of upper L. Erie in Mich. and Ohio, upper L. Champlain in N. Y. and Vt; near Ottawa, Ont., and at various places along the St Lawrence, proper, in Ont. and Que. (16). Muenscher has supplied manuscript notes on this species.

Bromus inermis Leyss. Locally abundant. MADISON: Munnsville, *R. L. Crockett* (S); ONONDAGA: roadside, Syracuse*; roadside near Green L., Fayetteville*; SENECA: roadside s. of Fayette*; CORTLAND: roadside, s. Cortland*; CHEMUNG: ballast, State Road, *S 591;* ditch-banks in the Jackson Ck area*; fields, Comfort hill*; roadsides, Horseheads*; roadside and fields, Pine City*. Also known locally from Sylvan Beach (62) and from several places in Tompkins co. (111); infrequent in the State (62).

Arrhenatherum elatius (L.) Mert. & Koch (50). Becoming common. ONEIDA: Bridgewater, locally abundant, *W 19957;* MADISON: fields near Pecksport, *H 16369;* ONONDAGA: along street,

Westvale*; old field, Fayetteville*; CAYUGA: nw. of Cascade, *F. A. Ward;* old cemetery, Venice, A; SENECA: abundant along road n. of Hector* and n. of Valois*; roadsides near Covert*; BROOME: meadows, 2 mi. e. of Binghamton, *M 16061;* TIOGA: dry roadside, 2 mi. nw. of Jenksville, *C & S 2639;* CHEMUNG: scattered clumps along road from county line s. to Pine Valley*; single clump, ballast, Erin*; rather common along main road s. of N. Chemung*; vacant lots about Elmira*. Not unusual in the northeastern part of the Finger Lakes region (22; 59; 111); formerly reported from Tompkins co. (111) and Apalachin (15) southward; infrequent or locally abundant in the State (62).

Holcus lanatus L. (*Ginannia lanata; Notholcus lanatus. Holcus L.,* nom. cons., type species *H. lanatus L.*—104). On the increase. ONONDAGA: Mud Ck, swampy meadow, 1½ mi. n. of Woodward, *M. J. Richardson 103* (S); Cicero Sw., *A. Horton 46* (S); meadow 1½ mi. e. of Three Rivers, *G. P. & F. L. Van Eseltine 2688* (S); CAYUGA: near Sempronius, *A;* CHENANGO: half-way between Mt Upton and Norwich, *Wr & Wr;* CHEMUNG: Sullivanville, *C. A. & M. W. Taylor 3135* (T); Lowman, *L* (A); becoming frequent about Erin*, as formerly in Tioga co. (26) and the Cayuga basin (111); STEUBEN: along road between Caton and Sagetown, *S 2068;* ONTARIO: Gorham, *H. P. Sartwell* (S). Frequent in the Hudson valley and on L. I. (81); less so northward and westward (62).

Commelina communis ludens (Miquel) Clarke. (*C. communis,* at least in part, of manuals—95). Occasional about cities. CHEMUNG: Elmira, on ballast, *S 540;* in shrubbery about Elmira Heights*; STEUBEN: e. of Corning, *M 15306.* Typical *C. communis L.* has never been observed by the writer, the material about Ithaca and Syracuse being the present plant. The species (undifferentiated) is infrequent in the Hudson valley and on L. I. (81); also reported from about the big cities of the Barge Canal belt (62) and Ithaca (111).

Leucojum aestivum L. Rarely established. CAYUGA: wet field, Port Byron, "persisting for 25 yrs.," *M 17572;* TOMPKINS: wet soil along run about 1 mi. n. of Bald hill, *J. P. Young 17361.* Previously reported from sweetflag marsh near Peterboro; often persistent in old yards (62).

Iris Pseudacorus L. Locally naturalized . MADISON: Chittenango gorge, *R. L. Crockett* (S); south of Oneida, *House 14250* (A); TIOGA: several patches in wet pasture, jct. of Richford-Caroline and Speedsville roads*; CHEMUNG: along each of 3 small brooks, State Road*, Scotchtown*, Breesport*. Swamp n. of Salina (43); 5 scattered stations in the Cayuga basin (111); well established along Cayutta Ck near Waverly (76). It is not understood why some colonies should be so extensive, and the last 3 new localities cited should harbor but a single clump each.

Populus candicans Ait. Occasional. (62; 111) MADISON: Page camp, *R. L. Crockett* (S); ONONDAGA: near Syracuse, *L. M. Underwood* (S); Danforth, *M. L. Overacker* (S); TOMPKINS: roadside n. of Connecticut hill, *M 17575;* CHEMUNG: spreading by suckers, old farm yard, Redfern hill, *S 881*.

Polygonum cuspidatum Sieb. & Zucc. (*P. Zuccarinii*—77). Occasional. MADISON: Munnsville, *R. L. Crockett* (S); ONONDAGA: salt flats, Onondaga L., Syracuse, *M. & D. Isely 20153;* CAYUGA: weedpatch, Auburn*; CHEMUNG: several clumps on waste ground along Newtown Ck s. of Brick pond, Elmira, *S 2302*. Not reported by the local floras; considered locally common in the Hudson valley and across the middle of the State (62); near Quaker Bridge (66).

Cerastium tomentosum L. (5) Rare. ONONDAGA: a few clumps along roadside, vacant lots, Syracuse*; CHEMUNG: patch, about 6 ft across, along the Watkins road s. of Pine Valley, *S 776*. Not hitherto reported.

Silene Armeria L. Not too successful. TOMPKINS: spontaneous about C.C.C. Camp SP-48*; CHEMUNG: spontaneous in garden at Erin*; 1 plant along curb, W. Water st., Elmira, *S 345*. At North Bay (59); Onondaga Valley (43); not recently collected in the Cayuga valley (111); not reported by Clute, although in Tioga co. (26); "in waste places and spontaneous in gardens and recently cultivated soil" (62). Apparently inability to compete with weeds not controlled by garden operations prevents its spread.

Dianthus deltoides L. Rare. CHENANGO: roadside between Triangle and Greene, *S &D 1148*; TOMPKINS: roadside near Speedsville, *L. Coville 16565*; scattered along roadside, Ithaca, *B* (B); roadside, Forest home, *J. Cohn* (Cn); CHEMUNG: pasture lane, lower Maple av. flats*. Infrequent in the State (62); but formerly listed only from Baldwinsville (43) for our region.

Ranunculus repens L. var. **pleniflorus** Fern. Occasional (62; 111). TOMPKINS: spontaneous in yard, Ithaca, *B* (B); yard, Van Natta road, *B* (B); CHEMUNG: moist ditch Pine Valley, *L* (E); along roads about Erin* and State Road*; formerly abundant in swaly pasture, Scotchtown*. Hitherto reported for the State from Herkimer, Albany, Onondaga, Seneca, Monroe, Tompkins and Genesee counties (22; 62; 111).

Berberis Thunbergii DC. (99) Following the generic tradition. TOMPKINS: woods n. of Esty glen *C et al. 19141*; abandoned field, Coy glen, *M 17885*; woods, n. side of Remington B., Cayuga Heights, *M 17480*; hedgerow along Ellis Hollow road, *S 1552*; slough in Slaterville Sw.*; wild bank, Fleming Meadow*; CHEMUNG: seedlings and 1 bush approximately 3 yrs old, edge of lawns, Erin*; full-grown bush on thicketed slope near Breesport*. Also JEFFERSON: 1 bush in Thuja bog, Sackets Harbor*; GENESEE: edge of Bergen Sw., *M 19518*. Reported by W. T. Winne as frequent about Schenectady; rare in Erie co. (113).

Fumaria officinalis L. Generally rare, but locally abundant. MADISON: Georgetown, *M. A. Phillips 19398*; CAYUGA: garden, Moravia, *A*; CHENANGO: weed in peafield near Sherburne, *G. J. Raleigh 19714*; CORTLAND: escaped in garden, Cortland, *E. L. Palmer 537*; CHEMUNG: garden, 5th ward, Elmira, *L* (E); old flowerbed at Erin* (persistent?); abundant weed on the alluvial flats between Elmira and Wellsburg*. Hitherto reported for our region from Geddes gorge, near Syracuse (43); McKinneys, near Ithaca (111) and Chemung (15). Occasional in the State (62).

Sedum ternatum Mx. Scarce, but locally abundant. ONONDAGA: e. of Syracuse, *L. Hamilton* (S); CAYUGA: creekbank, Moravia, *Dr M. F. Merchant*; SENECA: woods along stream in Lodi glen, *M 16164*; TOMPKINS: abundant over lawn, Dryden*; CHEMUNG: hilly ground near Roericke's glen, *L. E. Chase* (E); spread over Jakeway's lawn, Breesport, *S 783*. As about Ithaca (111), the plant, once started, spreads rapidly. Rare or sporadic (14; 43; 62; 111). Apparently none of the stations is an indisputably native occurrence.

S. spurium Bieb. (*S. stoloniferum* Auct., non Gmel.—5) Very rare. TOMPKINS: small clump along road near old house site, Hungerford quarry, Ellis Hollow road, *S 1584* (B); CHEMUNG: 2 small patches on clayey bank along road, Scotchtown, probably escaped from the near-by cemetery, *S 445*. Otherwise reported for the State from St Huberts, Essex co. (62). (True *S. stoloniferum* appeared once on a stone pile near Erin, but was soon smothered out by the next species.)

S. sarmentosum Bunge (5) Occasional. TOMPKINS: small clump along road, Hungerford quarry, *S 1494* (B); CHEMUNG: spreading rapidly over stone pile near rock garden, Erin, *S 1040*. Formerly reported for the State only from Crestwood, Yonkers (10).

Ribes sativum Syme. (*R. vulgare*—5) Occasional (62; 111). MADISON: Nine Mile Sw., Hubbardsville, *M & Cu 5224*; CAYUGA: lakeshore s. of Union Springs, *W & E 12137*; CHEMUNG: near Seely Ck bridge, *L* (E); gravel pile, Erin* (a temporary escape); wet woods along streambank, Erin* (apparently well established); wet upland woods, Laurel hill*. In connection with these notes, it is well to recall Wiegand and Eames (111): "In the dry-soil stations, the plant appears to have escaped directly from cultivation, but in the boggy places, it seems to constitute part of a general introduction into low ground throughout eastern North America and is apparently spontaneous."

x **Spiraea Billiardii** Herinc. (*Douglasii* x *salicifolia*) (99) New. CHEMUNG: spreading about an old foundation, Fairview, *S 427*; abundant along roadside ditch near old farmhouse, Redchalk*; STEUBEN: about old gravel pit, edge of Caton Sw.* Perhaps only persistent, although definitely seeming to spread.

Filipendula rubra (Hill) Robinson. 5 new localities. MADISON: Oneida, *R. L. Crockett* (S); TOMPKINS: roadside, Trumansburg, *B*; roadside, s. side of Connecticut hill, *M 16980*; along Ellis Hollow road near Hibbards Corners*; large patch in damp field near Asbury Church, *fide* M. Sand, florist. Near Oneida L. (59); 3 other stations in Tompkins co. (111); occasional in the State (62).

Rubus phoenicolasius Maxim. Occasional. CAYUGA: well established in several places nw. of Cascade, *F. A. Ward*; in pasture, Moravia, *A. E. Salley 15706*; TOMPKINS: woods above gun works, Ithaca, *M 17385*; woods near the Chi Psi house, Cornell U. campus*. "Sparingly escaped" in se. N. Y. "and rarely elsewhere" (62).

R. laciniatus Willd. Occasional. TOMPKINS: Several large bushes in old field, Danby road, South hill, Ithaca, *S 1190*; about duckpond at the Fuertes Bird Sanctuary, head of Cayuga L.* (planted ?); YATES: Penn Yan, *G. R. Youngs* (S). Also known from near Mud pond, Conquest (111) and se. N. Y. (62).

Rosa gallica L. Local. TOMPKINS: roadside near Ithaca, *B* (B); roads ne. of Slaterville Sw.*; CHEMUNG: old cemeteries, Scotchtown*, Austin hill* and Blueberry hill*; grassy banks, Mud Lick road*; STEUBEN: dryish banks near Caton Sw.*. Hitherto reported from Tyre, Spencer, Michigan Hollow, and Danby (111) for our region. Sparingly naturalized or escaped in the State (62).

Prunus fruticosa Pall. (99) Rare. TOMPKINS: crossroad beyond upper reservoir, Six Mile Ck, Ithaca, *W 15716*. Observed for several years by Weigand and others.

Amorpha fruticosa L. Increasing. SENECA: sandy fields near Pout pond, Junius, *M. & V. M. Lefler 18362*; TOMPKINS: near Stewart av. bridge, s. bank of Fall Ck, *S. H. Burnham 18572*; vacant lot ne. of suspension bridge, *M 14798*; Connecticut hill, *M 18011* (var. *angustifolia* Pursh); ONTARIO: Black Pt, Canandaigua L., *Mrs E. P. Gardner*. Reported eastward and southeastward in the State and from near Rochester (62); occasional, but not considered established, in the Cayuga Lake basin in 1926 (111).

Robinia viscosa Vent. Locally established. TOMPKINS: forming a thicket of more than ½ acre on hillside n. of Groton, *M 20188*, the annotation label reading: "Also observed along roadside just south of Cayuga county line." Well established in the State, eastward, at least (62); North Bay, Oneida co. (59); possibly escaped at Aurora (111); Waverly (26); rare in Erie and Niagara counties (113).

Lathyrus latifolius L. Occasional; 5 new stations. ONONDAGA: abundant in swaly field, N. Syracuse, *S & M. E. Faust 2336* (S); factory roadside, Syracuse*; SENECA: roadside between Hector and Hector falls*; TOMPKINS: old field near Lloyd Cornell Wild Flower Preserve* (incl. albino); ONTARIO: roadside

near Black Pt, Canandaigua L., *Mrs E. P. Gardner*. Occasional in the State (62); also near Constantia (59) and at 3 other Tompkins co. stations (111) for our region.

L. tuberosus L. Very rare. CHEMUNG: abundant and spreading about cellar of abandoned house site on Erin branch of Marsh road, Rodbourn marsh, *S 18904*. Previously reported for the State from Fishers I. (45) and from the town of Amherst, Erie co. (113). Also JEFFERSON: alfalfa field near Chaumont bay, 5 mi. from Three Mile Bay, *W. T. Winne;* ERIE: town of Clarence (adjoining Amherst), *J. K. Wilson 20040*, near Harris hill, Amherst, *C. A. Zenkert* (1933).

Euphorbia lucida Waldst. & Kit. The number of recent collections would indicate that this species is decidedly on the increase; since, however, the plant does not usually produce seeds in this country, and since it is so extremely localized (80), the additional colonies were probably overlooked. BROOME: open dry roadside, Union, *W 4496*; 1 mi. w. of Binghamton, *L. F. Randolph 2*; TOMPKINS: Groton, *W. R. Dudley* (1875—first from State ?); gravelly roadside n. of Townley Sw., *E 10234*; e. of Townley Sw., *Wr 15740*; Peruville, common along roads in Lansing Twp, *B* (B); 2 mi. e. and ⅓ mi. n. of N. Danby, *L. Coville 17605*; TIOGA: roadside and field e. of Spencer, *M 16990*; roadside, Smithboro, *M 17499*; jct. of the Halsey-Valley and Spencer-Candor roads*; STEUBEN: field s. of Sonora, *M 15738*. 2 other stations in the southern part of the Cayuga Lake basin (111) and a few others in the Susquehanna valley proper (14; 111); new to the Chemung. Also JEFFERSON: in grass by the roadside near village of Black River, *M & B. Maguire 2373*; roadside, s. of Watertown*.

Aesculus glabra Willd. Very rare. CHEMUNG: small flowering tree along roadside, Millport run, *S 768*; STEUBEN: Branchport, *T. M. Fry* (S). Not previouly reported for the State.

Impatiens Roylei Walp. (5) New. MADISON: s. of Eaton, *R. L. Crockett* (S); SCHUYLER: in woods, the Glen springs, Watkins, *M 17252*.

Hibiscus Trionum L. (*Trionum Trionum*) Occasional. MADISON: vicinity of Hamilton, *W. F. Langworthy*; ONONDAGA: garden, 1 mi. s. of Marcellus, *N. Hotchkiss 960* (S); Syracuse, *L. M. Underwood* (S); CAYUGA: Locke, *Mrs Arthur Jones;* TOMPKINS: weed in cultivated ground, Bailiwick, Ithaca, *B* (B); CHEMUNG: cornfield weed, Scotchtown*; STEUBEN: vicinity of Campbell, *G. D. Cornell* (Cl). In Onondaga co. (22); scarce to locally abundant in the Cayuga basin (111); only at Wellsburg (14) and Barton (26) in the Susquehanna valley heretofore; infrequent westward in the State and in the St Lawrence, Champlain and Hudson valleys (81).

Oenothera pilosella Raf. (*O. pratensis*; *Kneiffia pratensis*—62; 84). Increasing. TOMPKINS: roadside at Halseyville, *B* (B);

spontaneous among currant bushes, yard, Cornell Heights, *D 18074*; roadside near girls' playground, Cornell U. campus, *A. Gershoy 6928*; field along Fall Ck about 1½ mi. above Varna, *W & E. Palmatier 20205.* Reported from brackish meadows, Montezuma (111); elsewhere in the State from the southern and southeastern sections (62) and from Concord, Erie co., and Lakeport, Niagara co. (113).

Aegopodium Podagraria L. Occasional. TOMPKINS: weed in athletic field, s. of ball-cage, *E 10534* (with variegated leaves—var. *variegatum Hort.*); dooryard, Ithaca, *E 4674* (var. *variegatum*); CHEMUNG: wet bank, Erin* (var. *variegatum*); curbing, N. Main st., Horseheads, *S 810.* Reported for the southeastern part of the State (62).

Primula veris L. (5) Occasional. MADISON: Colgate campus, well established for 40 years, *M &G. L. Stebbins 18970*; CAYUGA: in woods far from any house, in glen near rr., between Kings Ferry and Willetts, *W 7003.* Not previously reported from the State, although one of the hybrid derivatives has been found on Connecticut hill, Tompkins co. (10).

Convolvulus japonicus Thunb. Scarce. MADISON: Wampsville, *R. L. Crockett* (S); ONONDAGA: streets of Syracuse*; TOMPKINS: st. n. of W. Hill schoolhouse, *S. H. Burnham 17408*; CHEMUNG: Rumsey hill, *G. Rumsey* (plant observed in Rumsey garden); Hendy Hollow, specimen collected by Hendy Hollow 4-H Club and retained in the club's collection; edge of cornfield, Scotchtown*. The specimens are all of the double-flowered form. Scarce in the Cayuga basin, where reported only from the vicinity of Ithaca (111); locally abundant in the State (62).

Lamium maculatum L. Still occasional. CAYUGA: Moravia, *F. L. Kilborne*; TOMPKINS: roadside near Peruville, *H. H. Craig*; McLean, *W. W. Rowlee*; Ellis Hollow, *W* (The *L. album L.* reported from this station (111) has been redetermined by Wiegand as albino *L. maculatum*); roadsides, Boyceville*; chickenyard, Trumbulls Corners*. Onondaga co. (22); 3 other stations in Tompkins co. (111); sparingly naturalized in the Susquehanna valley (14); infrequent or rare throughout the State (62).

Salvia pratensis L. (5) Rare. MADISON: Old pasture, south of Clockville, *House 14141*; gravelly field, 3 mi. w. of Peterboro, *M et al 20230*; CAYUGA; ½ mi. w. of Venice center, *E & W. E. Manning 16732.* Reported as occasional and persistent if undisturbed (62); listed from Onondaga co. (22).

Origanum vulgare L. Rather rare. MADISON: in field near Hatch L., *M & A. A. Lindsey 3547*; ONONDAGA: Manlius, *A. Westcott* (S); CAYUGA: roadside between Cayuga and Auburn, *E. J. Townsend*; weedy roadside, Auburn*; SENECA: near Seneca L., Lodi, *N. W. Folwell*; along roadside between Lodi and Caywood, *M 17283*; TOMPKINS: Six Mile Ck switchback, *J. Lewis 17413*;

several places on Cayuga heights *fide Muenscher*. Locally abundant eastward in the State (81), but, for our region, hitherto definitely reported only from Onondaga co. (43) and 2 stations in Broome co. (14).

Verbascum phlomoides L. Appearing. TOMPKINS: Cornell U. campus, *S. H. Burnham 18636*; abundant in barnyard near White Church*, escaped from a commercial flower garden; in cinders about C.C.C. Camp S-125* (cinders transported from near White Church). Also JEFFERSON: stony pasture s. of Adams*. Heretofore reported for the State only from Wading River, L. I. (62), and from Eighteen Mile Ck, Erie co. (113). Considered "as yet rare" by Pennell (94).

Cymbalaria muralis Gaertn., Mey., & Scherb. (*Linaria Cymbalaria*—94). Rare, with "little aggressive tendency—doubtfully to be included in our flora" (94). TOMPKINS: city dump, lighthouse road, *M 15924*; CHEMUNG: a considerable quantity on dripping stone wall under bridge, Elmira*. Otherwise reported from Onondaga Ck (43), the hills about Cornell U. (111) and Owego (15).

Veronica Chamaedrys L. Increasing. CAYUGA: yards, Moravia, *A*; CORTLAND: orchard, w. end of village of Truxton, *W*; TOMPKINS: Baker lawn, Cornell U. campus, *M. Pladeck 17296*; lawn, E. Seneca st., *S. H. Burnham 17619*; bad weed, lawn se. of Sage, Cornell U. campus, *S. H. Burnham 17618*. Rare in the State (81); formerly reported in our region only from the vicinity of Syracuse (43).

Lonicera Morrowi Gray (99). Becoming established. ONONDAGA: old field near cemetery, Fayetteville, *S 2157* (S); TOMPKINS: on rocky waste in Hungerford quarry, Ellis Hollow road, *S 1631*; CHEMUNG: n. slope of Reservoir hill, Horseheads, *S 816*; stony thicket, Cobble hill*. Also LIVINGSTON: abundant on Leroy lime barrens, *M 18999*; ALBANY: common in fence rows, Loudonville, *H 19040* (B). Much material casually referred in the field to *L. Xylosteum L.* may actually be this species, here apparently first reported for the State.

Valeriana officinalis L. Occasional. CAYUGA: Moravia, *F. L. Kilbourne*; SENECA: roadside, Lodi, *B* (B); TOMPKINS: old hedgerow along Turkey Hill road, *C 920* (B); bottomland along Fall Ck, 1½ mi. above Varna, *W. &E. Palmatier 20240*; ditch near village of Dryden*; CHEMUNG: Pine Valley, *L* (E); willow-thicketed sloughs near rr., Erin* and Rodbourn*. In Onondaga co. (43); 3 older scattered stations in the Cayuga basin (111); infrequent, but widely distributed in the State (62).

Campanula Trachelium L. Very rare. TOMPKINS: Six Mile Ck, *C. A. Taylor jr, 18156* (1932); collected by others over several seasons. First from the State.

Rudbeckia triloba L. Increasing. ONONDAGA: old pasture n. of Tully*; TOMPKINS: between greenhouse and Tower road,

cornell U. campus, *Al 17639;* vacant lot overgrown with weeds, Cornell st., Ithaca, *Al* 19027; roadside, College town, *J. Cohn* (Cn); wet, grassy pocket, Cornell quarry, Ellis Hollow road*; abundant about small slough in Slaterville Sw.*; old pasture n. of Dryden*; CHEMUNG: wildly spreading weed in garden, Erin, *S 521*; gravelly riverbank, W. Elmira*; banks of Newtown Ck, Elmira*. Formerly reported for this region only from the Ithaca dumps (111); also in the Hudson valley (62).

Coreopsis lanceolata L. Recently noticed. TOMPKINS: many plants along dead furrow, far from any house, along hill road to Upper Enfield, well established, *S. H. Burnham & W. R. Dann 17439*; CHEMUNG: covering vacant lot, Center Mills, *S 523*; several plants along gravelly roadside e. of Breesport*; ONTARIO: weedpatch, Geneva*. Reported in 1924 as "adventive or escaped .....in a few localities in southern New York" (62), and more recently as "very freely" escaping on Fishers I. (45); as frequent about New York City (78); by Winne as established about Schenectady and as scarce in the Buffalo region (113).

Anthemis tinctoria L. Spreading little, but tenacious where once started. ONONDAGA: Tamarack Sw., *M. L. Overacker* (S); dry roadside, Comstock av. *M. E. Underwood 222* (S); dry soil, Syracuse U. campus, *M. E. Underwood* (S); TOMPKINS: College farm, Cornell U. campus, *A. R. Bechtel 11013;* grassy roadside, Garden av., Cornell U. campus*; CHEMUNG: gravelly roadsides, Erin, *S 1011*, near Scotchtown cemetery*, and Traynor farm, Laurel hill*. Some of the material is *A. Kelwayi Hort.* which scarcely seems distinct (5). Infrequent or rare in the State (62); in Onondaga co. (22); not established in the Cayuga basin in 1926 (111).

Artemisia pontica L. Still occasional. TOMPKINS: just below the narrows, near Caroline center, *C. L. Wilson 17525.* Reported from the W. Junius region and from near Enfield falls (111); rare in s. N. Y. and occasional elsewhere (62).

Onopordum Acanthium L. Occasional. MADISON: Hamilton, *R. L. Crockett* (S); TOMPKINS: city dump, Lighthouse road, *M 16330*; 3 mi. s. of Jacksonville, *G. Personius 5316*; abundant in rocky pasture hollow, n. edge of Slaterville Sw.* Also ST LAWRENCE: roadside, Lisbon, *O. P. Phelps.* Reported from widely separated areas in the State (62; 111; 113); for this region previously, only from the Cornell U. campus, a pasture n. of Slaterville and Penn Yan (20; 111).

II NEW AND RAPIDLY SPREADING WEEDS

The recording of fluctuations in the weed population is an important function of any floristic work. A number of weeds, once known from but a station or two for the area here considered, are now known from several counties and are fairly prevalent. Among such

may be mentioned *Pycnanthemum flexuosum* (see below), *Potentilla recta* (81) and *Camelina microcarpa* (81). Many are new to the region, several to the State. Years of collection have been cited after specimens as an added indication of time of introduction and rapidity of spread.

Bromus arvensis L. Rare. TOMPKINS: Cornell U. farm plots, *F. P. Metcalf 5810* (1916); Stewart Park lawn, *Al 17700* (1932). Otherwise known for this country from a few localities in the Hudson valley (62) and eastern Md. (50).

B. mollis L. (*B. hordeaceus* Auct., non L.—51). Rare and recently introduced. MADISON: Pecksport, *R. L. Crockett* (var. *leiostachys* Hartm.— *B. hordeaceus f. leptostachys*) (1940) (S); TOMPKINS: Plant Science lawn, Cornell U. campus, *S. H. Burnham 17695* (1932); Lake st., Ithaca, near corner of Cayuga L., *S. H. Burnham 19960* (undated); in gravel (said to be from Fall Ck, Varna), Turkey Hill nursery, *S 1140a* and *S 1140* (the latter var. *leiostachys*) (1939). Infrequent in the Hudson valley and on the coastal plain (81); apparently local elsewhere (62); listed from Onondaga co. (43).

B. tectorum L. Becoming common, at least locally (81). ONONDAGA: Warner, *F. B. Armstrong* (1910); near salt marsh between Liverpool and Syracuse, *W 1725* (1914); CAYUGA: sandy hillocks e. of Lowery ponds, *C et al. 2572* (var. *glabratus* Spenner—50) (1937); TOMPKINS: 1 mi. beyond McKinneys between rr. and lake, *M. D. Pirnie 13891* (1921); near Hoy field, Cornell U. Campus, *S. H. Burnham 16054* (var. *glabratus*) (1925); rr. track, Brooktondale station, *Al 17449* (1930); sandy bank near greenhouses, Cornell U. campus, *Al 17562* (1931); Eames' garden, Cayuga Heights, *E 17703* (1932); Lick Bk, *W 19302* (var. *glabratus*) (1936); gravelly field, Slaterville Sw., *S 593* (var. *glabratus*) (1937); idem* (var. *typicus*) (1937); gravelly soil in Turkey Hill nursery, *S 777* (var. *glabratus*) (1939); CHEMUNG: along rr. at Erin, *S 594* (1937); n. of Red Jacket inn, *S 784* (1938); along rr. at Breesport* (1939) and Breesetown* (1940); abundant along sts. of Horseheads* (1939). Our material of var. *glabratus* is usually taller, with a more diffuse panicle. Taller plants with strigillose, and shorter sparsely villous, glumes have been noted, however; also one colony of taller, more diffusely panicled var. *typicus*. The species has been reported for our region from Onondaga co. (22), Cayuga (111), Ithaca (111) and Preble (63).

Puccinellia distans (L.) Parl. Very rare. TOMPKINS: ditch, site of old Remington salt plant, *W 19837* (1938). Hitherto reported for our area from Liverpool, Syracuse, the Montezuma region and Penn Yan (62; 111).

Poa nemoralis L. An 8th county. ONTARIO: Canandaigua, *Miss E. C. Webster* (1910). Previously reported from Tompkins

(111) (where increasing), Onondaga (43), Yates (62), Fulton (58), Richmond (62), Westchester (10) and Cattaraugus (65) counties.

P. bulbosa L. Rare. TOMPKINS: under tree, lawn, East av., Cornell U. campus, *Al 18722* (1935). Also at Riverhead, L. I. (28). Reported from Va., N. C. and several western states (50).

Eragrostis spectabilis (Pursh) Steud. (*E. pectinacea* Auct., non Nees.—50). Rare or locally abundant. ONEIDA: North Bay, *R. L. Crockett* (1939) (S); Sash-factory Ck, *R. L. Crockett* (1941) (S); OSWEGO: sandy roadside n. of Bernhard's Bay, *H 20111* (1932); MADISON: sandy roadside s. of Oneida, *H 24449* (1936) w. of n. Chittenango, H *27190* (1939); ONONDAGA: widespread in sandy fields, N. Syracuse, *S & M. E. Faust 2310* (1941) (S); SENECA: sandy field, Junius, *Al 18266* (1933); CHEMUNG: a few clumps along rr., Elmira Heights, *S 2314* (1941); YATES: Penn Yan, *H. P. Sartwell* (date unknown) (Bu). Also WARREN: sandy roadside sw. of Sugar Loaf mt., town of Queensbury, *S. H. Burnham* (1916); WASHINGTON: sandy field sw. of Moss St. schoolhouse, Hudson Falls, *S. H. Burnham* (1916); dry soil, Thompson, *H 24091* (1936); SARATOGA: "along D. & H. rr. n. of Saratoga Spa," *circa* 1916, *fide* ms. notes of *S. H. Burnham*; SULLIVAN: sandy and gravelly roadside, 2½ mi. nw. of Lackawaxen, Pa., *C. A. Taylor jr* (1941) (T). It is difficult to distinguish the var. *sparsihirsuta* Farw. (23) in these collections, the material varying from nearly glabrous to densely villous-hirsute within a single colony, with some variation found on individual clumps. Previously reported only from Apalachin (15) for our region, *E. pectinacea* of Egler (22) presumably being the plant now so named—a species relatively abundant about Syracuse. Also on L. I. (62). Undoubtedly adventive upstate, since it is too spectacular a plant to have been overlooked by Paine and other earlier botanists.

E. peregrina Wiegand. Probably overlooked rather than extremely rare. ONONDAGA: rr. tracks n. of W. Genesee st., Syracuse, *N. Hotchkiss 1708* (1924) (S); TOMPKINS: gravelly roadside, Paige's Corners, Slaterville Springs, *S 1062* (1938); old rr. crossing, Besemer* (1938); CHEMUNG: cinders at rr. crossings, Erin, *S 1035* (1938), Bowman Hill road, Horseheads, *S 1018* (1938), and N. Main st., Horseheads, *S 1019* (1938); roadside, Goodrich Corners, *S & W. T. Winne 4001* (1941); also in dense mats or as scattered plants along road from there to Big Flats, a distance of 8 mi.* (1941); STEUBEN: cinders about filling station, Gibson, *S 1060* (1938). Also ALBANY: Watervliet, *C. H. Peck* (1905); JEFFERSON: rr. yard, Watertown, *M. L. Fernald, W, & E 14171* (1922). Otherwise reported for the State only from Onondaga co. (22), Auburn (111), Ithaca (111), Quaker Bridge (65) and Collins (113).

E. Frankii C. Meyer (50). Occasional. ONEIDA: Sylvan Beach, *H 24381* (1936); n. bank of Fish Ck, *M 14573* (1922);

MADISON: Lakeport, *H 9868* (1923); Lewis Pt, *H 24355* (1939); CAYUGA: rather abundant in small tufts along county road near Slayton's pond, *S 1831* (1940). Very rare locally, whence previously reported from Onondaga co. (22), the Cornell U. farm (111), Apalachin (14), and possibly Big gully (111); cited as frequent in the State (81).

Dactylis glomerata L. var. **detonsa** Fr. Very rare. CAYUGA: meadows etc., cult., Moravia, *F. C. Curtice,* in part (1881); TOMPKINS: Taughannock ravine, *E 5726* (G), *E 5728* (1916), the latter possibly transitional. Hitherto reported for N. A. only from Newfoundland: "Probably introduced in hay or straw and presumably more generally naturalized." (32). Abundant in the woods near the lake entrance to Taughannock gorge, where it presents a strikingly distinct aspect; the entire plant slender, with seemingly narrower, darker green leaves; the lower branches of the panicle much longer, slenderer, and more flexuous; the glumes, both sterile and flowering, smaller than in the usual variant and nearly or completely glabrous. Occasional plants of the large variety with shorter basal panicle-branches have glabrate glumes, but the material cited is part of a well-constituted variety.

Cynosurus cristatus L. Still occasional. ONONDAGA: grassy roadside, Dewitt, *C. A. Weatherby 3705* (1915); Euclid av., lawns near Syracuse U. campus* (1941); CAYUGA: lawn, Moravia, *A* (1891); TOMPKINS: E. Seneca st. lawn, *S. H. Burnham 17706* (1932); CHEMUNG: lawns about Erin* (1936); ONTARIO: Canandaigua, *Miss E. C. Webster* (1910). Not common in the State (62); in addition to these new records, reported for our area from Onondaga co. (43), Ithaca (111) and Campville (15). Sometimes used in lawn mixtures (50), but seeming more or less casual here.

Sporobolus cryptandrus (Torr.) Gray. Rare. TOMPKINS: grass along the Lehigh Valley rr. tracks near the Barge Canal terminal, Ithaca, *M 17744* (1932). New to the Cayuga basin; elsewhere in our region only about Onondaga L., although frequent on the Great Lakes lowlands; also on L. I. (62).

S. vaginiflorus (Torr.) Wood. Increasing. ONEIDA: sandy soil e. of Verona beach, *H 26132* (1938) (S); ONONDAGA: cultivated field, Tully, *G. F. Hastings* (var. *typicus*) (1898); near Archbold stadium, Syracuse U. campus, *S & M. E. Faust 2322* (1941) (S); CAYUGA: common in old fields between Aurora and Kings Ferry, *M 18281* (1933); SENECA: roadside, Covert* (1941); TOMPKINS: along road near Agriculture College greenhouses, Cornell U. campus* (1936); cinders about C.C.C. Camp S-125* (1937); TIOGA: along road, 3 mi. e. of Slaterville Springs, *S 635* (1938); CHEMUNG: roadsides ne. of Erin, *S 613* (1936), at Scotchtown* (1937), Breesetown* (1937), Horseheads* (1937), Rush run* (1940), Sullivanville* (1941), and from Lowman through N. Chemung to Breesport* (1941); along rrs., Erin* (1939), near Elmira College* (1940), and Elmira Heights* (1941). All material

is var. *inaequalis* Fern. (33) except the second collection, as noted. Also reported for our region from Onondaga co. (43), Tioga co. (14), where not uncommon, and from Penn Yan (62); widely scattered throughout the State (62).

S. neglectus Nash. 4 more stations for our region. ONONDAGA: ballast near stadium, Syracuse U. campus, *S & M. E. Faust 2322a* (1941) (S); TOMPKINS: waste places near salt plant, Ithaca, *W. W. Rowlee & V. C. Dunlap* (1916); CHEMUNG: along rr. tracks, Erin, *S 1295* (1939); along rr., Elmira Heights* (1941). Also JEFFERSON: common about Madison Barracks* (1941). In Onondaga co. (22); considered frequent in the Cayuga basin (111); a few other scattered stations in the State (62). Appearing definitely introduced.

Aristida dichotoma Mx. Increasing, at least along rr. beds in CHEMUNG: near Precision Tool Co., Elmira, *S 618* (1936); Erin* (1937); Breesport* (1937); Park Station* (1937). About Oneida L. (59), vicinity of Syracuse (43), Apalachin (15) and presumably elsewhere; considered locally abundant in the State (62).

Eleusine indica (L.) Gaertn. Appearing about the cities (62; 111); occasionally elsewhere. ONONDAGA: lawn near stadium, Syracuse U. campus, *S & M. E. Faust 2324* (1941) (S); CAYUGA: lawn, Moravia, *A* (1881); TOMPKINS: increasing about Ithaca sts., rr. yards and waste places (several collectors); Renwick woods, in path, *C 2267* (1936) (B); gravelly roadsides, C.C.C. Camp S-125, *S 1061* (1938); CHEMUNG: sts. e. of Elmira College, *S 619* (1936); about curbings, Elmira Heights* (1936); alluvial borders of Brick pond* (1941); YATES: Penn Yan, *H. P. Sartwell* (date unknown) (G). Hitherto definitely reported for the region from Oneida L. (59), Onondaga Hill (43), Waterloo (85), and Ithaca (111); common in the Hudson valley and on the coastal plain (81).

Panicum dichotomiflorum Mx. Occasional, but perhaps increasing. MADISON: sandy shore, South Bay, Oneida L., *M 14558* (depauperate) (1922); TOMPKINS: Tower road, Cornell U. campus, *S. H. Burnham 17355* (intermediate between vars. *typicum* and *geniculatum*) (1929); Plant Science lawn, Cornell U. campus, *S. H. Burnham 17727* (depauperate) (1932); edge of runway, Ithaca airport* (depauperate) (1940); CHEMUNG: roadside above Goodrich Corners, *S 623* (1936); old field near Elmira southside dumps, *S 622* (1936). Elsewhere reported for us from Oneida L. (62), Salina (62), and Tioga co., where frequent or locally abundant along the river (26); rare in the Cayuga inlet and outlet (111) as generally upstate (62), but frequent in the Hudson valley and on the coastal plain (81). Some of the moist-soil colonies are probably indigenous.

P. dichotomiflorum Mx. var. **geniculatum** (Wood) Fern. (38) Much more rare than var. *typicum* in our region, although apparently common elsewhere in the State, judging from collections. MADISON: shore of Oneida L., Lewis Pt, *H 24360* (1939) (S); TOMPKINS: near the Cornell U. barns, *S. H. Burnham 18273* (1933)

CHEMUNG: in sandy alluvium, Elmira eastside dumps, *S 624* (1936); abundant along rr. near Elmira College, *S 2309* (1941); along road, Greatsinger Corners* (1941). Although intermediates are not lacking, the two extremes of this species are markedly distinct. (Some of the depauperates may belong here, but their extremely dwarfed condition makes it difficult to determine.) In older reports, no varieties are distinguished.

P. clandestinum L. Occasional as a weed; still rare in natural occurrences. CORTLAND: rr. bank, Truxton, *W* (1896); CHEMUNG: large colony of very vigorous stout-culmed clumps along rr. tracks near Elmira Precision Tool Co.* (1936) and another on rr. bank, Pine Valley* (1940); slender few-culmed clumps on gravel-bars near the Chemung narrows* (1939) and in thickets, Greatsinger Corners Sw.* (1940); stout phase along rr., n. of Pipeline, Cayuta Ck* (1941) and slender phase in alluvial woods near-by* (1941). Considered infrequent westward in the State (62); in Onondaga co. (22); Montezuma and 3 Ithaca stations cited for the Cayuga basin (111); not previously reported from the Chemung valley, although common in the remainder of the Susquehanna drainage (14).

Setaria verticillata (L.) Beauv. (*Chaetochloa verticillata. Setaria* Beauv., nom. cons.—104). Occasional, but spreading rapidly, once established. ONONDAGA: fence row along Harrison st. near Greyhound Bus terminal, Syracuse, *S & M. E. Faust 2554* (1941) (S); also along other sts.* (1941); CAYUGA: Moravia, *A* (1918); TOMPKINS: city dump, Lighthouse road, Ithaca, *M 17741* (1932); waste ground near sludge tanks, Ithaca, *M 17740* (1932); along Spencer st., Ithaca* (1938); curbing, Williams st., near Cornell U. campus* (1941); CHEMUNG: curbing, Horseheads, *S 1040* (1938); ballast, Hoffman's nursery, Elmira* (1941); ONTARIO: garden, Canandaigua, *Miss E. C. Webster* (1910). Locally reported only northeastward (43; 59) up to now; considered infrequent in the State (81).

Bulbostylis capillaris (L.) Clarke (*Stenophyllus capillaris. Bulbostylis* Kunth, nom. cons.—104) Becoming abundant, at least along rrs., through the center of the region (10). MADISON: Oneida, *H 26182* (1938) (S); ONONDAGA: near ne. corner, Onondaga L., *S &M. E. Faust 2546* (1941) (S); TOMPKINS: about C.C.C. Camp S-125* (1937), in cinders from old rr. bed, Caroline Depot; behind Freeville ballpark* (1938); CHEMUNG: Elmira southside, *S 570* (1936); Erin* (1936); Park Station* (1936); Van Etten* (1936); Breesport* (1936); Breesetown* (1936); near Elmira College, *S 2310* (1941); Van Etten Jct.* (1941). Hitherto reported for the Susquehanna valley only from the river flats opposite Apalachin (15); for the Finger Lakes area from the sands of Oneida L. (54), from E. Syracuse (43), about Cayuga L. (10), where increasing; probably to be found general along railroads throughout. Most of the material is var. *crebra* Fern. (previously considered typical—39), but part of that from near Elmira College has sessile basal spikelets, and is apparently referable to var. *typica* (var. *cryptostachya*).

Carex hirta L. Another locality. CAYUGA: low meadow near South Central depot, Auburn, *A* (1886); flat waste ground near Lehigh Valley rr. freight depot, Auburn, *A* (1921). Also at Ithaca and Boonville, and on L. I. (62) in this State; reported from Onondaga co. (43).

Juncus compressus Jacq. ONONDAGA: salt marsh, Syracuse, *W* (1912). Also QUEENS: Coney I., *anon.* (1879). Otherwise reported for the State only from Ithaca and Freeville; rare in N. A. (111).

Allium vineale L. Recently noted. MADISON: Page camp, *R. L. Crockett* (1939) (S); WAYNE: in fields near Savannah, *L. E. Andrus 19515* (1936), "reputed to have been introduced with red kidney beans from California"; CAYUGA: lower Paine's Ck ravine, *M 18762* (1935); CHEMUNG: dry orchard thicket, Redfern hill* (1939). Frequent in the Hudson valley and on the coastal plains; rare on the Great Lakes lowlands (81); previously reported for our region only from Onondaga Hill (43).

Epipactis latifolia (L.) All. (*Serapias Helleborine. Epipactis* Zinn, apud Sw., nom. cons.—104. Doctor Schweinfurth, *in litt.*, states that the common European and sporadic American plant is distinct from *E. Helleborine* (L.) Crantz and should take the name here used). Definitely spreading. CAYUGA: near Auburn, *G. W. Boynton* (1904); OTSEGO: in woods, Summit L., *M & Cu 5182* (1935); CORTLAND: wooded brookside, State Reforestation area 9* (1937); TOMPKINS: ravine, Caroline hills, *E & M 16517* (1926); woods, Six Hundred tract near Slaterville Springs* (1936); woods n. of Summit marsh* (1936); wet thickets, State Reforestation area 2, *S 1361* (1939); TIOGA: wet woods, reforestation area 3* (1937); CHEMUNG: plentiful in dry or moist woods, Laurel hill* (1935); SCHUYLER: moist woods, Tobehanna L, *C 434* (1932) (B); dry woods, Arnot forest, *S &E. Van Duzer 559* (1936); YATES: clay bank, Clark gully, Middlesex, *M & P. R. Burkholder 16518* (1926). Also CHAUTAUQUA: moist soil in ravine, 3 mi. nw. of Mayville, *R. McVaugh & Cu 7160* (1937). Besides these stations, Cattaraugus co. (67) may be added to the picture of distribution presented by House (64), making a total of 29 counties thus far reported for the State. It is to be noted that House's map showed but one station for the Susquehanna valley (possibly a second from the McLean region), whereas most of the stations here cited are from that drainage. The Sayre specimen (1906) noted by Pretz (98) is of interest in that it indicates the species has been in the Susquehanna region for some years.

Rumex maritimus L. var. **fueginus** (Phil.) Dusen (*R. maritimus* of manuals, at least in part). New stations for the State. SENECA: w. side of Kipp I. on Route 31, *House 17842* (1930): CAYUGA: salt pond near Howland I., *M 17470* (1930). Hitherto reported only from L. I. (62) and Ithaca (111) for the State.

Chenopodium murale L. Occasional, but probably increasing. CAYUGA: in garden, Rempt farm, Venice Center, *M 18824* (1935); TOMPKINS: city dump, Lighthouse road, Ithaca, *E et al. 13945* (1921); weed in plant breeding garden, Cornell U. campus, *S. H. Burnham 17847* (1932); weed patch along Eddy st., Ithaca, *S, Al, et al. 20000* (1939). Infrequent in the Hudson valley and on the coastal plain (81); less common northward and westward in the State (62).

C. urbicum L. Rare. CHEMUNG: roadside, Elston farm, State Road, *S 360* (1936). At Syracuse (43); 2 northern stations and about Ithaca in the Cayuga basin (111); new to the Susquehanna valley; at Penn Yan (85); infrequent in the State (81).

C. carinatum R. Br. New to the State. TOMPKINS: weed in garden, Ithaca, *B* (1921) (B); "came up in greenhouse, Ithaca," *B* (1928) (B); Lehigh Valley rr. yards, Ithaca, *M 18310* (1939). An Australian species otherwise known from Mass., N. J., Mo., Tex., Nev. and Calif., in this country (1; 108).

Salsola Kali L. var. **tenuifolia** Meyer (*S. pestifer*). Increasing. ONONDAGA: Solvay waste, Syracuse, *W* (1902); sandy trolley tracks s. of N. Syracuse, *N. Hotchkiss 776* (1923) (S); locally abundant about the city* (1941); SENECA: along rr. from Geneva to Junius, *H. B. Brown* (1908); gravel pile near Ovid* (1941); TOMPKINS: Lehigh Valley rr. tracks n. of station, *F. P. Metcalf & W. 6394* (1916); Myers Pt, *E. & M 17852* (1932); field between greenhouses and Forest home, *S. H. Burnham 18527* (1934); CHEMUNG: along rr. near Precision Tool Co., Elmira, *S 361* (1936), and near Elmira Heights, *S 2316* (1941); ONTARIO: sts. of Geneva* (1941). Infrequent in the State (81); definitely reported for our area only from Onondaga co. (22) and the vicinity of Ithaca (111) up to now.

Oxybaphus nyctagineus (Mx.) Sweet (*Allionia nyctaginea*. The choice of *A. incarnata L.* as type of the genus conserves the name, *Allionia* Loefl., for the plants otherwise known as *Wedelia* Loefl., non Jacq., and prevents its use for the present group—7). Rapidly spreading in ballast, particularly along rr. tracks. MADISON: Cowaselon at rr., *R. L. Crockett* (1938) (S); ONONDAGA: along rr., ne. end of Onondaga L., *S & M. E. Faust 2544* (1941) (S); CHEMUNG: rocky bank of stream where reinforced, Breesetown *S & D 1235* (1939); along gravel fill at bridge, Breesport narrows, *S 1653* (1940); roadside near rr., West Jct.* (1941); along rr., Big Flats* (1941); SCHUYLER: abundant along road near Odessa, *S et al. 2080* (1941). Specimens have been cited (10) from Onondaga co., N. Spencer and Ithaca; undoubtedly elsewhere in our area; the new counties added to the previous report (10) making a total of 12 or 13 for the State.

Stellaria aquatica (L.) Scop. Very rare. OSWEGO: Hastings, abundant about the hotel* (1941); TOMPKINS: garden,

Judd Falls road, Forest Home, *S. 18839* (1935); JEFFERSON: Montario Pt, *House 19744* (1932); Infrequent in the State (62); not reported by the local floras.

S. pubera Mx. Very rare. TOMPKINS: n. side of Cascadilla Ck near footbridge, *C 1084* (1934); woods near Beebe L., *Miss M. Tingley* (1939) (retained in her collection). Also WESTCHESTER: in garden, Peekskill, *H. M. Fox 19392* (1936). Otherwise reported for the State only from Jamesville (43).

Silene dichotoma Ehrh. Scarce, but increasing. ONONDAGA: weed in field, Spafford, *Al 19864* (1938); CAYUGA: fields and waste places w. of Cascade near head of Owasco L., *F. A. Ward* (date unknown); fields, Summer Hill, *A* (date unknown); CHEMUNG: roadside near Mary Ann's Crossing, *S 1617* (1940) (B), Rush run* (1940), and Greatsinger Corners* (1940). Also locally reported from Fish Ck station (57), Marietta (91), Lafayette (43), the area between Cortland and Groton (111) and Ithaca (111); infrequent throughout the State (81).

S. Czerei Baumg. Vegetatively somewhat like *S. Cucubalus* Wibel, (*S. latifolia,* non Poir.—105), thus possibly overlooked; recent. ONONDAGA: in rich soil along old rr. switch bed, near ne. end of Onondaga L., *S &M. E. Faust 2550* (1941) (S); TOMPKINS: along the Barge Canal terminal, Ithaca, *M 17477* (1930), persisting and spreading somewhat to adjacent grasslands. Also KINGS: Canarsie, *J. Monachino 47*; ERIE: "common on waste grasslands" and rr. embankments about grain-elevators, Buffalo, *M 16101* (1940). Muenscher has supplied manuscript notes on the occurrence of the plant in this State. Reported from Ohio, Ind., Wisc., Minn., Ia. and Mont. (24). The plant reported from N. D. as *S. Fabaria (L.) Sibth. & Sm.* (106) is the same, judging from the description (47). Occurrence of the plant in some of the Wheat Belt states probably accounts for its being found about grain elevators and terminals.

Ranunculus bulbosus L. Scarce to locally abundant. MADISON: Oriskany Ck, *R. L. Crockett* (1936) (S); grassy bank under trees, Colgate campus, Hamilton, *M & G. L. Stebbins 18845* (1935); Cazenovia, *L. M. Underwood* (1879); ONONDAGA: loamy soil in dry pasture w. of swamp sw. of Round L., Fayetteville, *N. Hotchkiss 364* (1923) (S); fields near Manlius, *H 10037* (1924) (S); pasture in dry soil over limestone, Green L., *E, M, & W 17879* (1932); sts. of Syracuse* (1941); roadsides and fields n. of Tully* (1941); CAYUGA: Auburn, *E. J. Durand* (1894); Glenwood Beach, Owasco lake, *G. Arnold* (1919); OTSEGO: field near Otego, *M et al. 15486* (1924); CHENANGO: pasture, 3 mi. n. of Oxford, *M et al. 15485* (1924); CHEMUNG: ballast and beds, Hoffman's nursery, Elmira, *S 2076* (1941); YATES: Penn Yan, *G. Youngs* (undated). Onondaga co. (22); sporadic at the s. end of the Cayuga basin, more common northward (111); reported hitherto from 3

eastern stations (14) and Athens, Pa. (15), in the upper Susquehanna valley; frequent in the east central and southeastern part of the State (81).

R. sceleratus L. Decidedly weedy in certain localities. TOMPKINS: circle s. of Roberts hall, Cornell U. campus, *S. H. Burnham 18548* (1934); jct. of Stewart and South avs., Cornell U. campus, *S. H. Burnham 18549* (1934); CHEMUNG: moist places along Miller Ck, Big I., *R. McVaugh & Cu 7504* (1937); flats n. of Horseheads* (1938); more alluvial portions of Red Jacket Sw.* (1938); abundant on alluvial flats, Beaver Bk* (1940). About Oneida (59) and Onondaga (43) lakes; frequent in the Cayuga basin (111); rare (14) to infrequent (26) in the Susquehanna region (introduced there ?); new to the Chemung drainage; at Watkins (20); infrequent in the State (81).

Anemone canadensis L. Occasionally a weed. TOMPKINS: large patch in an old garden near rr. crossing, East hill, Ithaca*; CHEMUNG: rr. ballast, Erin, *S 754* (1935); Swartwood along rr.* (1937); grassy roadside near jct. of Greenbush and Marsh roads, Erin Twp* (1937). New to the Chemung valley; undoubtedly introduced at these stations; more or less common elsewhere in more alluvial soils (14; 62; 111).

Berteroa incana (L.) DC. Rapidly spreading. ONONDAGA: weed in field, Spafford, *Al 19873* (1938); SENECA: clover field just s. of Junius, *H. B. Brown* (1909); TOMPKINS: weed, Ithaca, *B* (1911) (B); in field near Newfield, *B* (1921) (B); roadside bank near hill entrance to Enfield glen, Newfield road, *S 728* (1936), possibly the same station as the last, recently observed to have spread over ½ mi. along road and through fields; plant science lawn, Cornell U. campus, *S. H. Burnham 18342* (1933); Lake View cemetery, Ithaca, *R. S. Snell 18863* (1935); Cayuga Heights, *E 19399* (1936); Cayuga Inlet valley near Lick Bk, *Al 19400* (1936); TIOGA: grassland, n. of Candor, *M 17892* (1932); CHEMUNG: Chicken park, Middle road* (1940); old field e. of Red Jacket Sw., *S, C, & R. Ross 2056* (1941); STEUBEN: grassy patch near road, E. Corning* (1940). Also ERIE: grassy wasteland, Buffalo, *M 16102* (1940). Previously reported for the region only from a roadside bank s. of W. Danby (111); considered frequent in the St Lawrence, Champlain and Hudson valleys (81).

Alyssum alyssoides (L.) L. New Counties. MADISON: rr. at Lillie farm, *R. L. Crockett* (1938) (S); CHEMUNG: banks of old canal n. of Horseheads, *S 806* (1938); along abandoned rr. near shalebank, Bowman hill* (1938). Also WASHINGTON: Goss' dried-up meadow, thin soil, Vaughns, n. of Hudson Falls, *S. H. Burnham* (1915); JEFFERSON: sandy field sw. of Sackets Harbor* (1941). Elsewhere locally at Syracuse (43), Skaneateles L. (10) and Ithaca (111); known from New York City (62), Monroe co. (62) and Buffalo (86), and more recently from Suffolk, Albany, Cortland and Genesee counties (10).

Descurainia Sophia (L.) Webb (*Sophia Sophia* Brit., *Descurainia* Webb & Barth., nom. cons.—7). Rare. TOMPKINS: about Lehigh Valley rr. Yards, Ithaca, *M 17377* (1929), persistent; Eames' yard, Cayuga Heights, *E 17930* (1932); sandy field between greenhouses and Forest Home; *S. H. Burnham 18873* (1935). Hitherto reported for the region only from Syracuse (43); rare in the State (81).

Alliaria officinalis Crantz (*Alliaria Alliaria*). Very local. MADISON: thicket, edge of alfalfa field, Peterboro Sw., *M & G. L. Stebbins 18857* (1935); OTSEGO: bank of creek flowing into Otsego L., at Three Mile Pt, near Cooperstown, *Al 16970* (1927). "Becoming frequent or common in some sections of the State" (62), but not previously reported by the local floras.

Erucastrum gallicum (Willd.) Schultz (*E. Pollichii*; the oldest specific name is "*gallicum*"—62). Scarce, but increasing. ONONDAGA: ballast near stadium, Syracuse U. campus, *S & M. E. Faust 2323* (1941) (S); reasonably frequent about the city (1941) *fide* Faust; CHEMUNG: roadside n. of Gee Sw., *S et al. 298* (1936); along rr., Elmira southside* (1936). Also of interest are: HERKIMER: roadside, s. side of Mohawk near Little Falls, *M & C 4650* (1934); ALBANY: gravel pits near Guilderland Center, *H 21976* (1934); JEFFERSON: ballast about motor shops, Madison Barracks* (1941); roadside sw. of Sackets Harbor, *S 3007* (1941); barnyard, Henderson Harbor* (1941). These and the report from Lewis co. (52) added to the Meunscher and Maguire summary (83) make a total of 11 counties for the State.

Bunias orientalis L. (48). New. TOMPKINS: wasteland near Agriculture College heating plant, Cornell U. campus, *T. C. Davis* (1914).

Cardaria Draba (L.) Desv. (*Lepidium Draba*—100). Increasing. TOMPKINS: pomology orchard, N. Y. S. Col. of Ag., *MacD 17588* (1931); CHEMUNG: roadside, Millport, *S 772* (1938). Also ONEIDA: grass along highway, 1 mi. s. of Oriskany Falls, *M 18870* (1935); ST LAWRENCE: abundant in grain-field, Stockholm, *O. P. Phelps 1416* (1915); GENESEE: roadside, 1 mi. w. of Batavia, *E & M 17915* (1932). At Syracuse and Astoria (62); rare in the northern and eastern lowlands and in the western part of the State (81).

Thlaspi arvense L. Infrequent (62; 81; 111), but spreading. MADISON: embankment of N. Y. O. & W. rr., Oneida Twp, *E 8152* (1917); SENECA: rr. tracks near Interlaken, *M 15520* (1924); TOMPKINS: Lehigh Valley rr. yards e. of inlet, Ithaca, *M 15521* (1924); near squatters' shacks along Taughannock blvd, *M 17934* (1932); along Lehigh Valley tracks s. of Ithaca, *C & A. Miller 570* (1933); cultivated field, hill n. of Enfield falls, *MacD 19405* (1936); roadside ne. of Slaterville Sw.* (1937); nursery beds, Turkey hill* (1937); CHEMUNG: old field, Scotchtown, *S 780* (1938); garden, Erin* (1939); along Watkins road n. of Horseheads* (1939); gravelly fields, Breesetown* (1941); YATES:

Keuka Park, *G. W. Seymour 510* (1927). Formerly reported from Fayetteville (43) and the southern end of the Cayuga basin (111) for our region.

Lepidium perfoliatum L. (108) Rare (81) and doubtfully successful. TOMPKINS: Lehigh Valley rr. freight yards, *M 16974* (1927); newly seeded lawn, plant science bldg., Cornell U. campus, *S. H. Burnham 17918* (1932); arboretum road, almost to test gardens, Cornell U. campus, *J. Shafer 20019* (1939). Also SARATOGA: Waste ground near race tracks, *House 27752* (1941). Hitherto definitely reported for the State only from Pittsford, Monroe co. (62).

Reseda lutea L. Locally abundant. MADISON: near Morrisville station, *E. G. Whitney 1449* (1931); gravelly roadside near Bouckville, *M & J. Stauffer 18874* (1935); Morrisville Sw., *R. L. Crockett* (1938) (S); gravelly bank along U. S. Route 20, near Pine woods, *M et al. 20173* (1940); ONONDAGA: in grass along road w. of Solvay, *M & D. Isely 20174* (1940); roadside, Fayetteville, *M. E. Faust* (1940) (S); Pompey hill, *M. E. Faust* (1940) (S). Also ORANGE: field e. of Port Jarvis, *M et al. 15556* (1924); LEWIS: sandy soil, roadside between Natural Bridge and Diana, *M & B. Maguire 2302* (1931); JEFFERSON: alfalfa field s. of Henderson Harbor, *M 2304* (1931); along roads between Sackets Harbor and Henderson Harbor* (1941); roadside s. of Watertown* (1941). Infrequent eastward in the State (81); on the Cornell U. campus (111).

Spiraea tomentosa L. Rare and local westward. CHEMUNG: old field near Elmira southside dumps and rrs., *S 428* (1936). Previously reported from 2 stations w. of Broome co. and Onondaga co.: Campville (15) and nw. Dryden Twp (111). Frequent eastward in the State, in the highlands and the northern valleys (81).

Potentilla Anserina L. Rare in the Susquehanna drainage, where mostly near the divide. TOMPKINS: roadsides near C.C.C. Camp S-125, *S 673* (1937); CHEMUNG: along rr. switch near Elmira Precision Tool Co., *S 431* (1936). Almost certainly introduced in both these stations. Otherwise known for the upper Susquehanna from Otsego lake (85), the Cortland marlponds (20), Summit marsh, Tioga co. (20) and Cayuta lake (20). More common northward (62).

P. arguta Pursh. Locally a weed. ONONDAGA: Otisco, *F. Cowles* (1889) (S); CAYUGA: sandy knolls, slope s. of Seneca R., n. of Port Byron, *S 1833* (1940); TOMPKINS: Giles st., Ithaca, *C. S. Marsh* (1890); mucky roadbed, Slaterville Sw.* (1937); TIOGA: w. side of Summit marsh, *W 18000* (1932); grassy roadside between Speedsville and State Reforestation area 1* (1937); CHEMUNG: sandy bushlot near Sullivan's monument, *S 84* (1937); open field, Cobble hill* (1938); cindered banks of rr., Pine Valley* (1940). It is difficult to determine whether some of the sand-stations are natural or acquired. Near Oneida L. (62); Onondaga co. (43);

scarce in the Cayuga valley where not previously reported from n. of Genoa Twp. (111); rare in the Chemung valley, whence hitherto reported only at Mountain House narrows (69); more frequent eastward in the Susquehanna (14; 15); at Watkins (20); new to the Ontario lowlands, except for the e. end (62).

Duchesnea indica (Andr.) Focke. Rare (81). ONONDAGA: Oran, roadside, *M. Jackson 253* (1926) (S); wasteplaces and cemetery, Fayetteville* (1941); TOMPKINS: increasing about Ithaca, where 9 different stations known, the oldest collection apparently by Bailey in 1916 (B). Formerly reported for our region from Syracuse (62) and Ithaca (111); on the coastal plain (62).

Sanguisorba minor Scop. (*Poterium Sanguisorba*). Additional stations. MADISON: Peterboro, *R. L. Crockett* (1939) (S); WAYNE: rr. tracks w. of Savannah, *E. H. Eaton* (1930); CAYUGA: old cemetery nw. of Cascade, *F. A. Ward* (1909); OTSEGO: near Fly Ck, Mud L., *S. H. Burnham* (1908); CHEMUNG: rr. yards near Elmira College* (1940). Rare in the State (81); locally reported, up to the present, from Onondaga co. (43) and 4 widely separated Cayuga basin stations (111).

Vicia tetrasperma (L.) Moench. Rapidly increasing. OTSEGO: Otego, *Anon. 15732* (1924); TOMPKINS: field near road, Slaterville Sw., *S 676* (1937); edge of woods and field, s. side of Cascadilla Ck, opposite N. Y. St. Col. of Ag. pomology orchard, *W 20041* (1939); CHEMUNG: old field, base of Sullivan hill, *S & B 1316* (1939); grassy bank, crest of Sullivan hill* (1939); alluvial flat, CHEMUNG narrows* (1939); grassy roadside between N. Chemung and Greatsinger Corners* (1939); SCHUYLER: dry gravelly roadside n. of Cayuta L., *M & D. Isely 20190* (1940). Hitherto reported only from Oneida L. (59) and Taughannock Pt (111) in the entire region; infrequent in the State, mostly in the Great Lakes lowlands (81).

Euphorbia Helioscopia L. More widespread than previously indicated. ONONDAGA: Manlius, *W. M. Smith* (1848) (S); Syracuse, *W. R. Dudley* (1878); near Onondaga L., *D. Keefe* (1884) (S); along Route 5 n. of Dewitt, *M. E. Faust* (1941) (S); CORTLAND: garden, Truxton, *W* (1893); CAYUGA: Moravia, *Anon.* (1876); garden weed, Kelloggsville, *F. L. Kilborne* (1882); TOMPKINS: weed in garden, N. Danby, *M 15096* (1923); STEUBEN: weed in backyard, Hornell, *R. Hall* (1934); ONTARIO: covering a field of over an acre e. of Canandaigua, *M 16359* (1926). Onondaga co. (43); 3 stations in Tompkins co., hitherto, and locally abundant farther n. on e. side of Cayuga L. (111); Norwich and Unadilla Forks (14); infrequent in the greater St Lawrence lowlands (81).

Hypericum prolificum L. Rare. SENECA: swale, sandy field near Cenchrus Road corner e. of Pout pond, Junius, *W 18378* (1933); CORTLAND: old pasture by roadside, Solon to Cincinnatus, *W 6812* (1916); 2 miles e. of Solon, *J. D. Kennedy, A;* (1942);

CHENANGO: near Bainbridge, *Mrs L. B. Fairbanks, A.* (1931). Also CATTARAUGUS: about ½ mi. e. of Farmersville Center, *E. Van Alstine 19755* (1937), the annotation label reading: "locally called sage brush. It has overrun considerable area of good pasture in the vicinity of Farmersville and Farmersville Center. It seems to spread from west to east by seed distribution and has extended from west to east a distance of about 10 miles in the course of a few years. The area infested is about 2 miles across from north to south." Hitherto reported for our region only from Fabius (43), although known just outside from Hannibal, Oswego co., where weedy in disposition (90). Presumably to be found in other parts of our region and the territory west. Rehder (99) gives the range as N. J. to Ia. and Ga., but the New York City records (62) may be for native colonies. Possibly an escape from cultivation, but behaving differently from most shrubby escapes.

Convolvulus arvensis L. Locally abundant. ONONDAGA: Syracuse, *W. M. Smith* (1838) (S); Fayetteville, *L. M. Underwood* (1879) (S); CAYUGA: garden, Moravia, *A* (1925); CORTLAND: abundant in old field, w. side of Cortland* (1941); TOMPKINS: West hill, Ithaca, *C 819* (1932) (B); along Ellis Hollow road near C.C.C. Camp SP-48* (1940); CHEMUNG: garden, Elmira, *L* (1898) (E); garden, Erin* (1925); roadsides n. of Horseheads* (1938), Breesetown* (1940), and Mt Zoar* (1941). Locally common on the Great Lakes lowlands, but infrequent elsewhere in the State (81); about Oneida L. (59); Marcellus (43); Ithaca, Esty's and Westbury bog for the Cayuga basin (111); definitely reported from Apalachin and Binghamton for the Susquehanna region (14), in previous papers.

Myosotis arvensis (L.) Hill. Occasional, and never very common. CAYUGA: yard, Moravia, *F. S. Curtis* (1881); near L. Como, *A* (1881); common in fields, Ensinore, town of Scipio, *G. Arnold 12788* (1919); Glenwood Beach, Owasco L., *G. Arnold* (1919); TOMPKINS: Ithaca flats, *W & C. E. Anderson 20063* (1939); CHEMUNG: lawn, Erin, *S 413* (1936). In Onondaga co. (22); scarce in the Cayuga basin, where, at least for the most part, about Ithaca (111); new to Clute's region. Locally common northward and westward in the State and reported from near New York City (62).

Echium vulgare L. Increasing. ONONDAGA: roadside n. of village, Tully, *E 7063* (1916); abundant in fields and along roadsides from Tully to Syracuse* (1941); TIOGA: gravelly slope e. of Spencer* (1925); CHEMUNG: roadside and rr. bed, Erin* (1925); ballast along road between Elmira and Big Flats, *S 125* (1937); along rr., Elmira Heights* (1941); STEUBEN: Goff farm, Coopers Plains, *G. D. Cornell* (1906) (Cl); since observed by Cornell as frequent in the vicinity of Campbell. Locally common in the northern and eastern valleys of the State (81); reported westward only from 2 stations in eastern Tompkins co. (111), Owego (26) and Elmira (14); rare about Rochester (62) and infrequent in the Niagara region (113).

Verbena stricta Vent. Rare, but increasing. ONONDAGA: dry open hillside pasture, 1 mi. s. of Marcellus, *N. Hotchkiss 702* (1923); CAYUGA: Botrychium woods and Duck Lake bogs, Conquest, *Wr & Wr 13791* (1920); SENECA: pasture hill sw. of Vandemark pond, *S. H. Burnham* (1931); TOMPKINS: rr. track n. of McKinneys, *F. P. Metcalf & W 7065* (1916); grassy place, lower end of Taughannock ravine, *C. L. Pratt 18402* (1933). Rare in the western part of the State and the Hudson valley (81); definitely reported from Onondaga co., Esty glen and Buttermilk glen (22; 111) for our region.

Dracocephalum thymiflorum L. (*Ruyschiana thymiflora* House—61; *Moldavica thymiflora* Rydb.—102). Very rare. CHEMUNG: a few plants, gravelly roadside, Bowman hill, *S 1370* (1940). Hitherto reported for N. A. only from Mass. (41), Ont. (25; 44), N. D. (106) and Ida. (25). "Native of W. Siberia, Turkestan, Russia; long since established in Finland, south and central Sweden; newly and increasingly adventive in Norway, Denmark and Germany—mostly with Russian clover and rye." (49).

D. virginianum L. has been proposed as type of the genus (7), thus conserving *Dracocephalum* L. for the plants otherwise known as *Physostegia* Benth., and rejecting the use of the former name for the genus called *Ruyschiana* by Miller and *Moldavica* by Adanson. This rejected interpretation of *Dracocephalum* is accepted widely—Bentham and Hooker; Engler; Boissier; Hegi; Bailey. Both of the substitute names were first proposed in works now suggested for rejection (103). The two genera involved are both in cultivation; choice of another generic type would prevent confusing nomenclatorial shifts in the horticultural record.

Lamium purpureum L. Rare. ONONDAGA: Harbor Bk, Syracuse, *K. Murray* (1888) (S); CORTLAND: garden, Cortland* (1941); TOMPKINS: n. side Six Mile ravine, *C 837* (1932) (B); CHEMUNG: abundant among evergreens, Furman's nursery, Elmira, *S 2003* (1941); among evergreens, Hoffman's nursery, Elmira* (1941). Infrequent in the State (81); otherwise definitely reported for our region only from Onondaga co. (22) and from 3 stations from Cornell University to Enfield (111).

Pycnanthemum flexuosum (Walt.) BSP. (*Koellia flexuosa. Pycnanthemum* Mx., nom. cons.—7). Locally abundant and rapidly increasing. ONONDAGA: weedy field in somewhat sandy loam by swamp, w. side of Mud pond, w. of Baldwinsville, *N. Hotchkiss 1735* (1924) (S); ditch, Syracuse road, Pompey, *M. R. Jackman 286* (1926) (S); CORTLAND: in open field sw. of Labrador pond, *C & W 3254* (1937); abundant in fields, South hill, Cortland* (1937); TOMPKINS: old field, Connecticut hill, *S 1095* (1934); abundant on hillside fields n. of Slaterville Sw., *S 997* (1938); TIOGA: Mutton Hill pond, *Wr, Wr, & G. B. Upton 12841* (1919); dry land, E. Waverly, *B* (1937) (B); CHEMUNG: pasture, Crown hill* (1934)*; top of shalebank in pasture, Laurel hill, *S 423* (1935);

pastures, Langdon hill* (1939) and Bowman hill* (1939); along rr. w. of Van Etten* (1941); STEUBEN: vicinity of Campbell, *G. D. Cornell* (1901) (Cl); now considered frequent there by Cornell. Elsewhere in our region, reported from Marcellus falls (43); 6 stations in southern and eastern Tompkins co. (111), where unknown in Dudley's time; Binghamton (14), Sayre, just across the state line (15), Campville (26), near Spencer L. (111), and on the Caroline pinnacles (111) in the Susquehanna valley. Infrequent in the State (62); reported only from Corfu to our west (113).

Nicotiana rustica L. Very rare. TOMPKINS: roadside, Judd Falls road near Forest Home, *S. H. Burnham 19903* (1938). Previously, for our region, only from Onondaga co. (43), but considered rare in central N. Y. and southward; infrequent westward (62).

Solanum nigrum L. var. **villosum** L. Rare and recent. TOMPKINS: Lehigh Valley rr. yards, Ithaca, *M 17514* (1930). Also reported for the State from 3 stations on L. I. (28; 78).

Pentstemon pallidus Small. A few more stations. SENECA: sandy fields, near Pout pond, Junius, *H. A. Schwartz 1398* (1940); TOMPKINS: gravelly field near Slaterville Sw., *S 929* (1938). Also RENSSELAER: upland meadow near Brainerd, *H 21393* (1934); ULSTER: dry hillside s. of Ashokan reservoir, *M et al. 15926* (1924); DUTCHESS: field near Poughkeepsie, *F. J. & G. W. Quinlin* (1925). Binghamton, Taughannock ravine, Valley Mills, Syracuse and Geneva previously cited for our region; 17 counties for the State (94); 4 more counties are now added.

Chaenorrhinum minus (L.) Lange (*Linaria minor*—94). Becoming abundant. ONEIDA: Lehigh Valley rr. tracks ne. of Sylvan Beach, *N. Hotchkiss 1806* (1924) (S); MADISON: Hubbardsville, *M & Cu 5306* (1935); ONONDAGA: wasteland s. end of Onondaga L., *W 7132* (1916); Lackawanna embankment n. of Jamesville, *H. Ellis 169* (1926) (S); CAYUGA: near Glenwood, Owasco L., *G. Arnold* (1919); Utt Pt.* (1938); SENECA: Interlaken, *M 15922* (1924); CORTLAND: above Little York, *G. Mekeel and A. R. Bechtel 8728* (1917); TOMPKINS: Cayuga inlet, *S. 1092* (1935); e. side Cayuga L. between Portland Pt. and Esty glen, *C & A. Miller 2223* (1936); borders of drives and paths, C.C.C. Camp S-125, *S 967* (1937), in cinders transported from the next station; Caroline Depot* (1938); behind ball park, Freeville, *S 962* (1938); waste ground n. of dairy bldg., Cornell U. campus, *S. H. Burnham 20232* (1940); CHEMUNG: Erin, *S 404* (1936), both along rr. tracks and wet foot of talus-slope near-by; Van Etten* (1936); Elmira* (1936). Except for the cases mentioned, the plants occur almost exclusively along rr. tracks. Once infrequent in the State (81).

Veronica didyma Ten. (*V. polita*—94). Recently discovered in the region. ONONDAGA: lawns, Summit av., Syracuse, *E 14048* (1921); TOMPKINS: weed in lawn and by roadside, Cook st., Ithaca, *E 7143* (1916); lawn near Prudence Risley hall, Cornell U.

campus, *W. E. Manning 17026* (1927); roadside, n. side of greenhouses near barns, Cornell U. campus, *W 20234* (1940). Infrequent in the State (81); listed by Pennell without definite frequency (94).

V. persica Poir. (*V. Tournefortii*—94). Rare. CAYUGA: garden, Moravia, *A* (1912); flower-bed, Glenwood Beach, Owasco L., *G. Arnold* (1919); CHENANGO: Norwich, *M. E. Fitch* (1888); TOMPKINS: McLean, *V. McCaughey* (1905); beds, Turkey Hill nursery* (1937); CHEMUNG: gardens, Erin, *S 2013* (1941, but known for years); roadsides, Rodbourn marsh* (1938); lawn, lower Maple av.* (1941). Infrequent in the State (81); also definitely reported for our region from Onondaga co. (43), the vicinity of Ithaca (111), Taughannock falls (111), Oxford (14) and Apalachin (15).

Orthocarpus bracteosus Benth. (97). Very rare. CAYUGA: a single specimen growing on rr. track (old switch), 50 rods n. of Locke depot, *A* (1918). Also NEW JERSEY: "Springfield," *G. Rebell* (1936). Not listed by Pennell (94).

Plantago indica L. (*P. arenaria*—96). Rare, and in our region confined to the vicinity of Ithaca, where spreading. TOMPKINS: Lehigh Valley rr. freight yards, *M 17032* (1927); new seeding on filled-in ground, Stewart park, *M 17299* (1928); roadside, College Town, *S. H. Burnham 18142* (1932); sandbank near Six Mile Ck, *S 1089* (1934). Infrequent in the State (81), and hitherto reported for our region only from the Ithaca dumps (1925) (111), where persisting.

P. media L. 2 new localities. ONONDAGA: University av. between Genesee and Madison sts., *L. M. Underwood* (1880) (S); James st. hill, *C. M. Bell* (1887) (S); lawns along Euclid av. near Syracuse U. campus* (1941); ONTARIO: in lawn, Geneva, *F. C. Stewart 17300* (1928). Otherwise reported for our region from Jamesville (43), Ithaca (111) and Canandaigua (62); infrequent in the State (81).

P. aristata Mx. Occasional. CHEMUNG: Hendy Hollow, collected by the Hendy Hollow 4-H Club (1937) (retained in the club's collection); SCHUYLER: dry field e. of Waneta L., *C 881* (1933). Sylvan Beach (56); 4 Tompkins co. stations (111); at Apalachin and Sayre (just over the state line) in the Susquehanna valley (15); infrequent westward in the State, in the Hudson valley and on the Coastal Plain (81).

P. virginica L. Rare. TOMPKINS: dry stony field, jct. of Newfield and W. Danby State roads, *W 17517* (1930); newly seeded lawn, plant science bldg., Cornell U. campus, *S. H. Burnham 18144* (1932). Considered common in the southern and western parts of the State (62), but for our region heretofore definitely reported only from Onondaga co. (43) and the vicinity of Barton (14).

Succisa australis (Wulf.) Reichenb. Increasing in the region from Union Springs to Auburn. CAYUGA: Island park, foot of

Owasco L., *A* (1911); small patch in swaly ground, just s. of Seneca R., ne. of Port Byron, *S 1828* (1940); considerable colony along marsh bordering Owasco outlet, just n. of Port Byron, *S 1835* (1940). Hitherto reported for our area from Auburn (111), the district between Union Springs and Montezuma (111), and the vicinity of Lisle (14); rare in the State (81).

Knautia arvensis (L.) Coult. (*Scabiosa arvensis*). Local. HERKIMER: W. Winfield, *M & A. A. Lindsey 3637* (1932); CHENANGO: N. Norwich, *E. B. Clark 16364* (1926); CORTLAND: Blodgett Mills, *M 17522* (1930); Tioughnioga R., n. of Marathon, *M et al. 20243* (1940); CHEMUNG: grassy bank along fence, top of Watercure hill, *L* (1893) (E). Locally abundant in the Allegheny plateau region (81); definitely reported from Cayuga Heights (111); new to the upper Susquehanna.

Lobelia spicata Lam. Increasing. MADISON: Palmiter bog, *R. L. Crockett* (1940) (S); TOMPKINS: abundant in swaly pasture, Slaterville Sw., *S 317* (1939) (incl. albinos and material which tends toward var. *hirtella Gray*); CHEMUNG: in meadows or on grassy hills, town of Ashland, *L* (1879) (tending toward var. *hirtella*); in grass near Seely Ck, Erie rr. bridge, Southport, *L* (1898) (E); open field, Comfort hill, *S & H. Scudder 937* (1938); (incl. 1 plant of var. *campanulata McVaugh*—71); single plant on the shalecliffs n. of Horseheads, *S, Al et al. 1255* (1939); STEUBEN: open woods, vicinity of Campbell, *G. D. Cornell* (1901) (Cl). Possibly native, but its abundance in places where formerly undetected indicates introduction. About Oneida L. (59); previously known only from McLean in the Cayuga basin (111); hitherto cited as rare in the Chemung valley, whence definitely reported only at Painted Post (4), although common eastward in the Susquehanna proper (14); frequent or locally common elsewhere in the State outside of the Adirondacks (62).

Vernonia crinita Raf. Recently detected. TOMPKINS: pasture, s. of Shurger's glen, *M 18445* (1933); pasture just w. of Route 34, n. of Esty, *D. E. Harrum 17642* (1931). New to the State.

Aster pilosus Willd. var. **demotus** Blake (*A. ericoides* Auct., non L.—6). Becoming locally abundant. MADISON: sandy soil near lake shore, South bay, *M 14949* (1922); dry fields near N. Chittenango, *H 25351* (1939); ONONDAGA: Fayetteville, *M. E. Faust* (1940) (S); TOMPKINS: around Chicago bog, *E 16758* (1926); Lehigh Valley freight yards, Ithaca, *M 17039* (1927); Forest Home, *S. H. Burnham 19015* (1935); CHEMUNG: high, dry crests n. of Chemung R., w. of Elmira, *C et al. 2083* (1935); old fields, Laurel hill* (1936), Langdon hill* (1938), Park hill* (1939), Austin hill* (1939), slopes n. of Quarry farm, Elmira* (1940), Mt Zoar* (1941); STEUBEN: West hill, town of Campbell, *G. D. Cornell* (1902) (Cl). Increase in abundance indicates a weedy disposition, the plant appearing introduced in the region. Originally

reported for our area from 2 Tompkins (20), 2 Tioga (15), and 2 Chemung (14) co. stations (another just across the state line—15); later common in the Cayuga drainage (111) and Tioga co. (26); about Oneida L. (59); in Onondaga co. (43); infrequent across the State s. of the Adirondacks (62).

Verbesina encelioides (Cav.) B. & H. Casual. TOMPKINS: city dump, Lighthouse road, Ithaca, *E 17067* (1927). New to the State.

Iva xanthiifolia Nutt. Infrequent throughout the State (81). ONONDAGA: roadsides and waste places, se. corner of Onondaga L., *W 7283* (1916); TOMPKINS: Lehigh Valley rr. yards, Ithaca, *M 17327* (1928); garden, Dusenberry Hollow, town of Dryden, *Al 20089* (1939). Specimens also seen from Saratoga, Columbia and Monroe counties. Previously reported for the State from near Albany (62), Fishers I. (45), Queens (78), St Lawrence (83), Onondaga (22) and Erie (113) counties.

Helenium nudiflorum Nutt. Very rare. TOMPKINS: borders of ponds in wet pasture, Slaterville Sw., *S 994* (1938). Rare in the Great Lakes lowlands, the Hudson valley, and on the coastal plain (81); in Genesee co. (113). Reported only from Onondaga co. (43) for our region, heretofore.

Matricaria Chamomilla L. (*Chamomilla Chamomilla*. This species has been designated type of the genus, thereby replacing *Chamomilla* Gilib. with *Matricaria* L.). New and as yet rare. MADISON: over a considerable area of rather gravelly wasteland, pea pickers' camp, Pine woods, *M et al. 20306* (1941). Otherwise known for the State only from the southeastern area (62).

M. matricarioides (Less.) Porter (*Chamomilla suaveolens; Matricaria suaveolens,* non L.) Rapidly increasing. ONONDAGA: along sts. near N. Y. Central station, Syracuse* (1941); CHENANGO: roadside e. of Greene, *S & D 1149* (1939); BROOME: along trolley tracks, Endicott, *M et al. 16003* (1924); CORTLAND: roadside near St Mary's Cemetery, Cortland* (1941); TOMPKINS: Cornell U. poultry farm, *M & A. Aslander 16365* (1926); near Roberts hall, Cornell U. campus, *W 17529* (1930); roadside, Boyceville* (1937); waste ground by Bool Greenhouse road, Ithaca, *M 20261* (1940); roadside, 1 mi. w. of Varna* (1941); TIOGA: roadside between Newark Valley and Oakley corners, *S & R. E. Ladue 700* (1937); roadside near Oakley corners, *S & R.E. Ladue 699* (1937); hilltop farmroad, 2 mi. e. of Perryville, *C & S 2645* (1937); CHEMUNG: roadsides and ballast, Erin *S 526* (1936); about sts. of Elmira* (1936); roadsides between Big Flats and Mountain House narrows, *S 128* (1937); near Gee Sw., Van Etten* (1937), State Road* (1937) and Palmer Ridge* (1937); cowlane, Moss' pasture, n. of Horseheads, *S 805* (1938); STEUBEN: common in dooryard, w. of Caton* (1941); ONTARIO: Canandaigua, *Mrs E. P. Gardner* (1915). Once reported for our

region only from Syracuse (43); rare in the State in 1924 (62), but more recently considered frequent, mostly in the northern and eastern lowlands (81); common on Fishers I. (45); at several places in Brooklyn and Queens (78); 4 stations westward (66; 113). Specimens have been seen from Clinton, Franklin, St Lawrence, Washington, Rensselaer, Columbia, Suffolk, Herkimer, Oswego and Jefferson counties, and Winne reports it as having been known about Schenectady for 20 yrs, a total of 25 counties for the State so far.

Artemisia vulgaris L. Increasing in the south-central part of our region. TOMPKINS: weed in arboretum garden back of Crescent, *Al 18164* (1932); TIOGA: stone pile near rr., Spencer, *S & D 1212* (1939); CHEMUNG: roadsides just below fork of Latta Bk road, *L* (1897) (E), Grand Central av. near county fairgrounds, *S 527* (1936), and lower Pennsylvania av., Elmira* (1936); low stony river island, Lowman flats, *S 64* (1937); stony banks between Big Flats and Mountain House narrows, *S* (1937); SCHUYLER: gravelly flats between Catherine Ck and rr., Montour Falls* (1937). Infrequent in the State (81); hitherto definitely reported from Verona (85), Onondaga co. (43), Barton (26); doubtfully from Union Springs (111). Cultivated (5), but its occurrence about here suggests introduction as a seed-admixture more often than as an escape.

A. ludoviciana Nutt. (incl. *A. gnaphalodes* Nutt.—8). Very rare. CHEMUNG: large patch along rr., just w. of Wellsburg, *S 1660* (1940) (B); large patch in old pasture near rr., Breesport, *S 2096* (1941). Also ALLEGANY: pasture, 1 mi. w. of Oramel, *W. Washbon* (1933). Hitherto reported for the State only from about Rochester (62) and in Erie co. (113).

A. annua L. New to the region. TOMPKINS: waste ground near Agricultural College greenhouses, *M 17037* (1927); CHEMUNG: Elmira southside rr. yards, *S 528* (1936). Infrequent in the St Lawrence, Champlain and Hudson valleys, and on the Great Lakes lowlands (81).

Carduus acanthoides L. Recent and rapidly spreading. ONONDAGA: a considerable quantity along road near Green L., Fayetteville, *S 2155* (S); SENECA: pasture s. of Lodi, *M 17314* (1928); TOMPKINS: Dryden, *L. J. Sweetland* (1912); in field, s. end of Michigan Hollow, *M & O. L. Justice 20251* (1940); in meadow sw. of Tompkins co. camp, *M 20252* (1940); TIOGA: in old field, Fisher Settlement, hill e. of Summit marsh, *M 17630* (1931); CHEMUNG: field near state nursery, *S, Al, et al. 1233* (1939); YATES: along roadside between Keuka Park and Penn Yan near Russell's cabins, *G. W. Seymour 1528* (1940). Also FRANKLIN: pasture between Hogansburg and Ft Covington, *M & O. L. Justice 19922* (1938); GENESEE: field near Batavia, *S. R. Shapley 18427* (1933). Not reported by any of the pertinent local floras; rare in the State (81).

Centaurea maculosa Lam. Rapidly spreading and locally abundant (81). ONONDAGA: roadside, Westvale* (1941); edge of

swaly field, N. Syracuse, *S & M. E. Faust 2332* (1941) (S); CHENANGO: Sherburne, *J. Mulligan 16333* (1925); CAYUGA: several acres from 3–4 mi. n. of Moravia, *T. Broderick* (1925); fields, Venice, *A* (1912); TOMPKINS: dry gravelly hillside field, roadside between Newfield Station and Newfield, *M 16771* (1926); roadside, Connecticut hill* (1936); TIOGA: meadow, Fisher settlement, e. of Summit marsh, *M 17645* (1931); CHEMUNG: very abundant on banks and flats along creek, Sullivanville, *B* (1935) (B), spreading for several miles up the gravel bars of the w. branch of Newtown Ck; gravelly roadsides, Park hill, *S 1017* (1938), n. of Horseheads* (1938), Horseheads* (1940) and vicinity of Millport and Pine Valley* (1941); along Newtown Ck, Elmira* (1941); abundant in hedges and along fencerows, Tompkins Corners* (1941); pasture, s. of Latta Bk.* (1941); SCHUYLER: roadside e. of Tyrone, *C. King & C 1395* (1934); roadside, Watkins Jct.* (1939); ONTARIO: roadsides, vicinity of Geneva* (1941). Near Pout pond; 2 stations in ne. Tompkins co.; previously reported only from near N. Spencer for the upper Susquehanna (111).

C. solstitialis L. Rare. (81) CAYUGA: alfalfa fields, Venice, *A* (1908); Genoa, *A* (1913); TOMPKINS: newly seeded lawn, Cornell U. campus, *S. H. Burnham 18183* (1932). Reported from s. Cayuga co. (89).

Leontodon autumnalis L. (*Apargia autumnalis*; *Virea autumnalis*. Choice of *L. hispidus* L. as type of the genus effects conservation of *Leontodon* L. for this group of plants—7). Mostly recent and still rare. TOMPKINS: Cornell U. garden, *W. W. Rowlee* (1889); CHEMUNG: abundant in pasture and spreading along the River road, e. of Big Flats, *S 724* (1937). Near Skaneateles L. (43); 2 other stations in s. Tompkins co. (111); new to the Susquehanna drainage; infrequent in the State (81).

Picris hieracioides L. Increasing. ONEIDA: sandy roadside, Lee, *E 7323* (1916); MADISON: roadside n. of Merrillsville, *H 26206* (1938); ONONDAGA: alfalfa field near Baldwinsville, *M 16337* (1925); alfalfa field near road, Jamesville, *M 17063* (1927); abundant along roads near Syracuse* (1941); sts. of Fayetteville, *S 2153* (1941) (S); CAYUGA: meadow, dry ridge e. of Levanna, *M 17530* (1930); Kings Ferry, *M 18443* (1933); roadside ditch about ½ mi. w. of Slayton's pond, *S 1830* (1940); roadside by swamp bordering Owasco outlet, n. of Port Byron, *S 1829* (1940); w. side of Owasco L., *M & D. Isely 20262* (1940); TOMPKINS: roadside, 2 mi. s. of Lake ridge, Lansing, *M 17531* (1930); near reservoirs, Six Mile Ck, fide D. Isely (1941); YATES: Kashong glen, w. side of Seneca L., *G. W. Seymour 1534* (1940). Definite reports for the State have been published only for L. I. (62), the vicinity of New York City (62), Onondaga co. (22), Slaterville Sw. (111) and Rochester (62); infrequent throughout the State (81).

Crepis capillaris (L.) Wallr. Still occasional. CAYUGA: abundant in lawn, 5 mi. n. of Port Byron, *S 1834* (1940);

ONTARIO: Black Pt, Canandaigua L., *Mrs E. P. Gardner* (1913). Elsewhere in our region, reported about Syracuse (43), Galen (111) and Ithaca (111); infrequent in the State (81).

Hieracium florentinum All. Becoming common in the general region as in the Cayuga basin (10) and in other sections of the State (81). ONONDAGA: Ram's gulch, *H. Ellis 11* (1926) (S); field s. of E. Green L., Jamesville, *C 2192* (1936); Fayetteville, *M. E. Faust* (1940) (S); roadside n. of Dewitt, *M. E. Faust* (1941) (S); dry field. N. Syracuse, *S & M. E. Faust 2344* (1941) (S); common about Syracuse* (1941); OTSEGO: old field n. of Springfield Center, *M & A. A. Lindsey 3671* (1932); CHENANGO: waste-ground on slope near golf course, n. of Oxford, *C & J. L. Edwards 2590* (1937); TOMPKINS: old field, Slaterville Sw.* (1937); rocky wastes, Cornell quarry, *S 1550* (1940), and fields near-by* (1940); CHEMUNG: abundant on gravelly ground, Elmira north-side dumps, *S 742* (1936); dryish ridge n. of Pine Valley* (1940); pastures, Red Jacket Sw.* (1941). At Oneida (56) and listed from Onondaga co. (22); previously reported only from Little York (111) and Apalachin (15) for the Susquehanna drainage in N. Y.

H. Pilosella L. Rather widespread on dry, somewhat stony hill-side pastures in many parts of the area *fide* Muenscher. MADISON: s. of Peterboro village, *M et al. 20305* (1941); CAYUGA: Aurora, *E. L. French* (1883); TOMPKINS: Baker laboratory lawn, Cornell U. campus, *M 17528* (1930); Cornell Country Club golf course* (1936); Cornell Arboretum Crataegus field (1940), *fide* Wiegand. Also, just outside our region, in BROOME: w. of Deposit, *M. 20307* (1941). Infrequent in the State (81); hitherto reported only from Cayuga Heights (111) for our area.

III SOME NATIVES, RARE AND OTHERWISE

The writer is particularly interested in the study of native plants and the relation of their distribution to various ecological factors. He presents here an account of such of these as are, or were, considered rare, or might otherwise be interesting. Certain groups are necessarily withheld for the present due to his faulty knowledge of them.

Pellaea atropurpurea (L.) Link. Unusual. SCHUYLER: cliffs about 3 mi. n. of Watkins Glen, e. shore of Seneca L., *M 16024a*. In the Jamesville and Chittenango regions (62); 7 stations about the lower end of Cayuga L. (111); at Penn Yan (62); reported only from Leroy to our west (62).

Cryptogramma Stelleri (Gmel.) Prantl. Another county. CAYUGA: Parsons ravine, nw. of Moravia, *A*. Several stations about the Finger lakes (12; 62; 111); only at Killawog in the Susquehanna drainage (14).

Woodsia ilvensis (L.) R. Br. Very rare westward. ONTARIO: Gorham, *N. W. Folwell* (1831–32). Once unknown from w. of the Cayuga basin; now reported from 3 stations there, all in Ontario co.: this, w. side of Canandaigua L. (21), and High point, nw. of Naples (12). Scarce eastward: Moravia (62); 3 stations about lower end of Cayuga L. (111); 7 on the northern fringes of the Susquehanna drainage (13; 14; 43; 111).

Cystopteris bulbifera (L.) Bernh. (*Filix bulbifera. Cystopteris* Bernh., nom. cons.—104). Scarce or rare in the upper Susquehanna valley. CORTLAND: ledges, Griggs gulf*; STEUBEN: Woodhull, *B. B. Stroud* (Bk). Common in the Finger Lakes region (62; 111); for the Susquehanna, previously reported from the Ouleout valley and the far northeastern portion (13); from Oxford, Killawog, n. of Apalachin, and Unadilla Forks (14). New to the Tioughnioga and Chemung valleys.

Athyrium pycnocarpon (Spreng.) Tidestrom (*A. angustifolium*—7, Art. 69). Infrequent in the Finger Lakes region; rare southward. MADISON: woods near Oneida, *H 17406*; shaded limestone talus, Perryville, *H 23197*; ONONDAGA: Dewitt, *R. A. Ware;* Onondaga Indian reservation, somewhat clayey soil in shady woods, *N. Hotchkiss 1829* (S); Peppermill gulch, *L. L. Goodrich* (S); lower end of Howlett's gorge, n. side, *L. Petry* (S); road to Phoenix, *L. L. Goodrich* (S); CAYUGA: n. side of Fillmore glen, *A*; swamp, Venice, *A*; woods on ridge sw. of Cascade, *C & W. C. Wilson 2404*; low woods, Scipio, *A*; Cascade, *A*; Botrychium woods at Spring L., *C & J. W. Thompson 41*; New Hope, *F. L. Kilborne*; TOMPKINS: low woods around Jennings pond, *E & C. L. Wilson 14986c*; rich woods on ridge nw. of Groton, *C & W. C. Wilson 2391* (B); beech-maple woods, Michigan hollow, *C & H. Trapido 3710* (B); ravine bottom, Six Hundred tract*; TIOGA: wet woods, State Reforestation area 3*. Infrequent (111) or locally abundant (62) across the middle of the State; in the Susquehanna valley, previously reported from the vicinity of Unadilla Forks and Van Etten (14).

Dryopteris dilatata (Hoffm.) Gray var. **americana** (Fisch.) Benedict (*Thelypteris dilatata* var. *americana. Dryopteris* Adans., nom. cons.—104). Very rare. CHEMUNG: Lowman Sw., *E. J. Winslow* (G), the only specimen seen from the upper Susquehanna valley, N. Y., although recently reported from Mt Ararat in Pa. (19). Also but 1 specimen seen from the Finger Lakes region (12). Once considered at least not rare in our area (13; 14; 43).

D. Goldiana (Hook.) Gray (*Thelypteris Goldiana*). Infrequent northward; rare southward. ONONDAGA: rich rocky woods, Dewitt, *R. A. Ware*; Jamesville road near Syracuse, *L. M. Underwood* (S); Peppermill gulch, S. Onondaga, *L. L. Goodrich* (S); Lafayette, *L. L. Goodrich* (S); CAYUGA: Hamblin woods, n. side of Fillmore glen, *A*; swamp, Venice, *A*; margin of swamp, Cascade, *A*; low woods, Scipio, *A*; TOMPKINS: foot of slope, just s.

of Lick Bk., *W 17350*; Freeville, *H. P. Deforest*; Groton, *I. G. Williams;* ravine bottoms, Six Hundred tract*. Scarce to locally abundant in the Finger Lakes drainage (62; 111); from the Susquehanna known for the vicinity of N. Franklin (13), Unadilla Forks (14) Nichols (27) and Van Etten (14).

Azolla caroliniana Willd. Rediscovered in the Cayuga basin. CAYUGA: pools in old Cayuga Canal bed, 2 mi. sw. of Montezuma, *W 17442* (1930); SENECA: Tyre, *C. H. Peck* (G); TOMPKINS: in sluggish ditch, entrance to Stewart park, Ithaca, *M 20105* (1940), spreading from introduction in 1938. Considered locally abundant in Central N. Y. and on the Ontario lowlands (11; 62), but not seen in the Cayuga basin from the time of Dudley (20) and Peck to 1930.

Botrychium simplex E. Hitchc. var. **tenebrosum** (Eat.) Clausen (*B. tenebrosum*—9). Very rare. TOMPKINS: mossy hummocks, Slaterville Sw., *S. et al. 1164*. At Baldwinsville (43) and Beaver L. (62), Onondaga co.; Ringwood, Odessa and Park Station (12) in the south-central part of our area. A total of 11 counties are listed for the State (9); the closely allied var. **laxifolium** Clausen (9) is listed from 2 stations in Tompkins co. and 1 in Chemung (12) for our region.

Ophioglossum vulgatum L. Presumably more overlooked than rare. MADISON: Lebanon, *B. M. Chandler* (S); ONONDAGA: Baldwinsville near Seneca R., *L. L. Goodrich* (S); on mound in dry pasture, 1 mi. s. of Marcellus, *N. Hotchkiss 695* (S); bogs, *W. M. Beauchamp*; CAYUGA: L. Como, *W. W. Rowlee;* Moravia *A*; near Auburn, *L. G. Williams*; s. of Mud pond, Conquest, *Wr & Wr 13309*; TOMPKINS: Danby and vicinity, *W. R. Dudley*; borders of Lake Marsh, Dryden, *anon.*; bog near Ringwood, *M. Ross 17540*; abundant in wet pasture, Slaterville Sw., *S et al. 1180*; CHEMUNG: swaly field, Rodbourn marsh, *S et al. 1308*; swaly fields, Beaver Bk, *S 1385*. 30 counties in the State (9; 12). Supplemental to previous reports (12; 14; 43; 54; 62; 111).

Equisetum palustre L. var. **americanum** Vict. (*E. palustre* Auct. amer.—73). At the head of a 2d Finger lake. SCHUYLER: near shore, se. corner of Seneca L., Watkins, *M 16801*; weedy, swaly meadow s. of Montour, S 2076. Local northward and on the Great Lakes lowlands (62); near Constantia (62) and Onondaga L. (43); in the Cayuga inlet region (111); rare in the State (81).

Lycopodium annotinum L. var. **acrifolium** Fern. 3 new stations, including a new county. CORTLAND: dry woods, Griggs gulf*; STEUBEN: upland woods, Meade's Ck, *G. D. Cornell* (Cl); Sanford Ck, Wayne, *J. G. Webster* (Cl). Several stations at the s. end of the Cayuga basin and in Schuyler and Chemung counties (12); locally common in the northeastern part of our range (22; 62); the species (undifferentiated into varieties) at 5 e. Susquehanna stations (14; 15); somewhat frequent westward in the State (65; 113).

L. obscurum L. var. **dendroideum** (Mx.) D. C. Eaton. Scarce. CHEMUNG: Sullivan Hill, *L* (E); dry fields, Crown hill* and Langdon hill*. Definitely reported for our area from McDonough, Park Station, Oakley Corners and Connecticut hill (12); no typical specimens of this extreme from the Finger Lakes drainage have been seen.

L. tristachyum Pursh. 2 more stations, including a new co. CHEMUNG: edge of dry woods, Austin hill*; STEUBEN: upland woods, Meade's Ck, *G. D. Cornell* (Cl). In Oneida (62) and Onondaga (22) counties; at several stations in the southeastern corner of the Cayuga basin and in adjacent Chemung and Schuyler counties. (12; 62; 111); occasional in the Susquehanna drainage (14); rare westward in the Southern Tier (65).

Selaginella rupestris (L.) Spring. Very rare in this region; a new station. TOMPKINS: Fall Ck gorge, on rock near footbridge by waterworks, *J. G. Webster* (1882) (Cl). Elsewhere in our region, definitely reported only from Taughannock gorge (111); listed as occasional in Onondaga co. (43); rare and local in the State (62).

S. apoda (L.) Spring (22). Rare. ONONDAGA: deep gravelly shore of small lake, Tully, *W & W 26*; wet pasture land s. of Borden's milk station, Apulia, *M 16392*; Apulia pond, *F. A. Ward*; OTSEGO: shore of Summit L., Springfield, *H 22874*; CHENANGO: abundant over hummocky ground, Greene Meadows, *S & D*; Broome: lawn, Binghamton, sent for identification to *R. W. Curtis, 17081*; CORTLAND: old log, swampy bank of stream, Cortland, *A*. Along s. shore of Oneida L. (54) and about Salina (85); reported from Unadilla Forks (14) and Green L., Preble (111), for the Susquehanna in our area; at Sayre, Pa. (15), just outside.

Pinus resinosa Ait. Infrequent, if not more common, at least in Chemung co. SENECA: s. bank of Lodi glen, *M 16030a*; CHEMUNG: old field, Redfern hill, *S & J. R. Smith 1293*; dry woods and declivities, Hendy Hollow, *L* (E); Mt Zoar, *L*; old fields, Laurel hill*, Bowman hill*, Ormiston hill*, Bird Ck*, hill s. of Latta Bk*; along the Chemung R. at various places*; STEUBEN: hills near Campbell*, where Cornell reports it frequent. Also on streambank, Seely Ck, Daggett, Tioga co., Pa.* Reported as scattered throughout Onondaga co. (43); previously cited only from Yates co. (85) and Letchworth Park (62) to the w. of the Cayuga basin, where confined to the hills of Tompkins co. (111), and from only Barton, the Chemung narrows, and n. of White church (15; 111) in the Susquehanna region, whence all of these stations, but the first.

Larix laricina (du Roi) Koch. Not too common. CHEMUNG: abundant in lower end of Red Jacket Sw., *S, Al, et al. 1277*; low swale, 1 mi. below Lowman, *L* (E); SCHUYLER: head of Seneca L., *W. M. Smith* (S); YATES: moist ground, w. side of Potter Sw., 2½ mi. ne. of Potter, *C 3425* (B); STEUBEN: Caton Sw.* Infrequent (111) to frequent (62) in the region.

Abies balsamea (L.) Mill. Rare in the higher hills and colder swamps. TOMPKINS: Michigan Sw., *C & H. Trapido 2433*; bog, Ringwood, *C & R. Smith 19056*; CHEMUNG: sphagnaceous borders of woods, Redfern hill, *S 880*; mucky, marly thickets n. of Seven Acres pond, *S 910*; swales, Park hill* and Searles Crossing*; Greatsinger Corners Sw.*; swamp at Chambers*; STEUBEN: Wayland Sw., *W 15181*; several trees in Caton Sw., *S 2065*. Also streambank thicket, Seely Ck, Daggett, Tioga co., Pa., *S*. Cicero Sw. (43); 7 stations in e. Tompkins co. (111); previously reported from 6 scattered stations in the upper Susquehanna (10; 14; 15; 85). Common northward in the State and at higher elevations; locally abundant elsewhere in swamps (62).

Potamogeton Vaseyi Robbins. Decidedly rare. CHEMUNG: mucky outlet, Seven Acres pond, *S 915*. Otherwise known for our region only from Cayuta L. (30) and Peterson L. near Savona (72); new to the Finger Lakes drainage.

Bromus latiglumis (Shear) Hitchc. (*B. altissimus*, non Gilib. —62, incl. *B. incanus*). Probably much more frequent than once supposed. ONEIDA: rich, bushy, shady roadside, n. of Oneida Ck, e. end of Oneida L., *N. Hotchkiss 1397* (f. *incanus* (Shear) Fern. —35) (S); MADISON: Bridgeport, *R. L. Crockett* (S); CAYUGA: Suckerport, between Moravia and Locke, *A*; TIOGA: along brook n. of Spencer L., *M. L. Fernald, W, & E 14579* (f. *incanus*); CHEMUNG: riverbanks and moist woodlands, Harrington's I., *L* (E); alluvial thickets, Ring Jct.*, Elmira*, Fitch's bridge*, Lowman*, along Cayuta Ck, n. of pipeline* (f. *incanus*); on rich wooded slope, Mt Zoar* (f. *incanus*); streambank, Newtown Ck below Latta Bk* (f. *incanus*); riverbank opposite Mt Zoar, *S 2086* (f. *incanus*). Perhaps infrequent in the State, with only 2 stations cited from the Susquehanna valley, hitherto (62); apparently more frequent in the Oswego drainage (22; 62; 111); f. *incanus* definitely considered rare in the State (62; 66; 111). Additional specimens have been seen from Essex, Washington, Saratoga, Westchester and Erie counties, that from the last referable to f. *incanus*.

Festuca octoflora Walt. var. **tenella** (Willd.) Fern. (*F. octoflora* Auct., as to northeastern race—31). Rare, but probably overlooked. SENECA: dry hill, Lodi, *N. W. Folwell*; TOMPKINS: dry thickets near Williams Bk, *S & E. Palmatier*; SCHUYLER: Hector falls, *fide* note on Folwell specimen; dry woods along Watkins Glen*; ONTARIO: Gorham, *H. P. Sartwell*. 7 stations previously cited from Tompkins co. (111); 5 other scattered stations from the State (59; 62), incl. Oneida L. and Penn Yan for our region.

Eragrostis capillaris (L.) Nees. Rare or locally abundant; perhaps overlooked. CHEMUNG: dry soil in talus-slope woods, just s. of Latta Bk, *S 2017*; dry slope, e. side Mt Zoar, *S 2087*; abundant along roads, edge of woods, crest of Sullivan hill, *S 2301*; abundant along railroads near Elmira College, *S 2312*; SCHUYLER:

dry stony oak thicket, steep bank of Lehigh Valley rr., town of Montour, *W 7554*. At 10 other scattered stations in the Finger Lakes drainage (43; 59; 62; 85; 111); only near Apalachin, elsewhere in the Susquehanna region (15).

Elymus virginicus L. var. **glabriflorus** (Vasey) Bush (*E. australis*—34). Occasional in the southern part of our range. OTSEGO: shore of Goodyear L., *M & Cu 5150*; TOMPKINS: Negundo woods, s. of Ithaca, *W*; CHEMUNG: Ashland river banks, *L* (A). All specimens cited belong to the hairy-glumed f. *australis* (Scribn. & Ball) Fern. The variety is known from Catskill, Greene co., the se. part of the State (62), Negundo woods (111), and the Allegany Park region (65), all previously reported material except that from Catskill being referable to the glabrous extreme.

Hiërochloë odorata (L.) Beauv. var. **fragrans** (Willd.) Richter (*Torresia odorata*, as to northeastern American plant. *Hiërochloë* R. Br., nom. cons.—7). Very rare and local. TIOGA: hummocky, springy ground near peatbog, Oakley Corners, *S 739*; CHEMUNG: swaly border of old Chemung canal, n. of Horseheads, *S 1373*. In Madison co. (22); infrequent or local on the Ontario lowlands, westward (62); reported from but 1 station in the Cayuga basin, that also on the Ontario plain (111); not hitherto reported from the Susquehanna drainage in N. Y., although recently cited from ne. Pa. in that river system (42); frequent northward in the State and locally s. to L. I. and S. I. (62). Also CHAUTAUQUA: Sherman, *J. W. Spencer*. House has suggested that the plant may be a relic of Indian introduction in our region.

Paspalum ciliatifolium Mx. var. **Muhlenbergii** (Nash) Fern. (*P. pubescens; P. ciliatifolium* of Wiegand & Eames—36). Rare. OSWEGO: sandy field near Cleveland, *House 27172* (1939); CAYUGA: sandy hill field near Seneca R., n. of Port Byron, *S 1825*. Rare on the Great Lakes lowlands (81); cited from Lowery ponds (111). Also in the Hudson and Mohawk valleys and on the coastal plain (62). Not previously reported from Cayuga co.

Cyperus esculentus L. Local. TOMPKINS: Hoy field, *S. H. Burnham 16921*; CHEMUNG: sandy flats, Elmira eastside dumps, *S 575*; scattered plants on gravel bars and points of Chemung R. near Mt Zoar, *S 2092*; STEUBEN: gravelly shore, Chemung R., Corning, *L. F. Randolph 9317*. Frequent on the Great Lakes lowlands, the Delaware-eastern Susquehanna uplands, and the lower Hudson valley (81); rather frequent in the Niagara region (113); definitely reported for our region as abundant on the northern fringe (62), as infrequent about Cayuga L. (111), as common in the Susquehanna valley in Tioga co. (26), and from Oxford, shores of the Susquehanna in Broome co., and Harrington's I. (14): a very spotty distribution.

C. erythrorhizos Muhl. Rare; perhaps casual. TOMPKINS: Federal Grass nursery, *W 19356* (1936); a few plants in sandy

alluvium at sw. corner of Cayuga L., *S 1244* (1939). Previously known only from a few plants on the se. corner of Cayuga L. (1914) (111) and about Oneida L. (59); frequent or common in s. N. Y. (62).

Scirpus polyphyllus Vahl. Rare and local. CAYUGA: woods, Jewett hill, sw. of Moravia, *A*; CORTLAND: Kenney Ck, Truxton, *W*; CHEMUNG: Hendy Hollow, *L* (E); swaly depression, s. side of Latta Bk, *S 2020*. Rare in the Cayuga basin (111), as elsewhere northward and westward in the state (62); local in the Susquehanna region (15; 20; 26; 111); at Penn Yan (85).

S. microcarpus Presl (incl. *S. rubrotinctus*—62) Occasional. CORTLAND: swale by road, upper Labrador valley, *W 9364*; river flats, Truxton, *W*; rr., just n. of S. Pierce Crossing, Truxton, *W* (var. *confertus* (Fern.) House); open swamp, Homer, *A*; TOMPKINS: roadside swale, bordering swamp, n. edge of Village of Dryden*; CHEMUNG: small colony in alder thicket, Red Jacket Sw., *S 1623*; SCHUYLER: roadside ditch n. of Alpine, *Gershoy 9365*. Common throughout the northern, central and western parts of the State (62); 7 other scattered stations in the Cayuga basin (111); not hitherto reported from the upper Susquehanna.

Eleocharis pauciflora (Lightf.) Link var. **Fernaldii** Svenson (*Scirpus pauciflorus,* as to eastern American plant—107). Still rare (62; 111). MADISON: ne. of Madison, *House 17619* (1930); ONONDAGA: in white marl along shore, Green L., *M & Cu 4983*; SENECA: marl of Lowery pond, *C 19091a*; CHEMUNG: marly bog area of Red Jacket Sw., *S 2097*. Reported from Long Branch (43); on 2 lake-points near Farleys (111); reported for the Susquehanna only from Tully L. (62) and the Spencer L. and Summit Marsh locality (111).

Eriophorum tenellum Nutt. Very rare. CHENANGO: McDonough, *Wr 11478*. In Onondaga co. (43) and at Junius (62) for the Finger Lake region; new to the upper Susquehanna; frequent in the Adirondacks and northern counties; elsewhere locally abundant to rare (62).

E. gracile Koch. Unusual. CORTLAND: s. shore of Green L., Preble, *A. R. Bechtel & W 7655*; floating bog e. of rr., Little York L., Preble, *W & W 1780*; CHENANGO: Warn's pond, *Wr, Wr, & G. B. Upton 11473*. At Cicero Sw. (43); at Venice and in the W. Junius bogs (111); 6 Tompkins co. stations (111); not reported by Clute, but in the Summit L. area, Otsego co. (85); the same general distribution in the State as the last (62).

E. spissum Fern. (*E. callitrix* as to common ne. representative—29). Rare. CHENANGO: bog between German and McDonough, *C & W. C. Wilson 2171*; CORTLAND: Labrador Sw., Truxton, *W*; TOMPKINS: Woodwardia Sw., *H. H. Whetzel 18750*. At Peckport (57); Cicero Sw. (43); in 5 other bogs about Cayuga L. (111); new to the Susquehanna drainage; frequent northward, local southward, in the State (62).

Rynchospora capitellata (Mx.) Vahl (*R. glomerata* var. *minor* —37). Professor Fernald states, *in litt.*, that Miss Gale's research demonstrates the specific distinctness of *R. capitellata* and *R. glomerata* (L.) Vahl.). Very rare in our region. CHENANGO: McDonough, *R. L. Crockett* (S). Reported from the swamps of Oneida L. (59) and from Centreville (43). Frequent on L. I. and in the lower Hudson valley; local up the Mohawk-Oneida gateway; at Narrowsburg and Stockholm (62).

R. capillacea Torr. Rare. MADISON: Palmiter bog, *R. L. Crockett* (S); ONONDAGA: wet boggy seepage near s. end of Apulia pond, *N. Hotchkiss 759* (S); CORTLAND: calcareous springy shore of Green L., Preble, *W*. Also in the W. Junius bogs, about Oneida L., and at Penn Yan for the Finger lakes; at Waverly and Little York L. in the Susquehanna drainage; rare to local in the State (62).

Carex siccata Dewey. Unusual in the Oswego River system. SENECA: sandy bank by road at Phillips pond, *W 19663*; dry sandy fence row, 1 mi. sw. of Pout pond, *W. E. Manning & W 16458*. Listed from Onondaga co. (43); reported from Apalachin (62); rare to local in the State (62).

C. diandra Schrank. Scarce. MADISON: sunny bog s. of Clockville, *H 22456*; ONONDAGA: E. Green L., Jamesville, *W*; bog, w. side Labrador pond, *W 15050*; CORTLAND: very wet marshy border of millpond between Cortland and Homer, *W 1837*; SENECA: shore of Lowery's pond, *W 19648*; STEUBEN: floating bog, Cranberry L., *R. McVaugh & Cu 7432*; large clumps in open area, Caton Sw.*; ONTARIO: Gorham, *H. P. Sartwell*. Oneida L. (59), Pecksport (58), L. Como (111), 4 Tompkins co. stations (111), and Penn Yan (85) cited for the Finger lakes; Summit L., Otsego co. (85), and Summit marsh, Tioga co. (111), for the Susquehanna; frequent or common northward in the State, but less so southward (62).

C. prairea Dewey. Unusual. CHEMUNG: large tussocks along old Chemung canal, Red Jacket Sw., *S 1613*; loosely caespitose or slightly creeping on hummocks, deeper part of swamp, S *1424*. Onondaga co. (22); at L. Como (111); 2 stations at the n. end of the Cayuga valley and 3 at the s. end (111); at Summit L., Otsego co. (85); new to the Southern Tier; Yates co. (85). Infrequent northward and across the State (62).

C. disperma Dewey (*C. tenella*, non Thuill—70). Occasional. ONONDAGA: Tully lakes, *G. F. Hastings*; E. Green L., Jamesville, *W*; CAYUGA: border of cold hemlock swamp, Sempronius, *A*; woods, Four-Town schoolhouse, 3 mi. e. of Moravia, *A*; swampy woods, ½ mi. e. of Sayles Corners, Sempronius, *A*; CORTLAND: Thompson Sw., Truxton, *W*; Green L., Preble, *W 1817*; WAYNE: Westbury bog, *F. P. Metcalf & C. C. Thomas 7692*; TOMPKINS: low woods, swamp e. of Slaterville, *E & W 3610*; CHEMUNG:

small clumps on fallen log in boggy woods, n. edge of Red Jacket Sw., *S 1504*; YATES: Penn Yan, *H. P. Sartwell*; ONTARIO: Gorham, *H. P. Sartwell*. Frequent in Tompkins co. (111); only 3 eastern stations reported from the upper Susquehanna (14; 15); common northward, but less so or local southward in the State (62).

C. tetanica Schk. Locally abundant. CHEMUNG: creeping over extensive area, Horseheads flats, *S 1397*; scattered culms appearing from buried rhizomes on many tussocks, Red Jacket Sw., *S et al. 1423*. One of the commonest sedges on the marshlands between Horseheads and Millport; new to the Southern Tier. Reported from Onondaga co., near Enfield Ck, the Junius bogs, Crusoe L., Penn Yan and Sullivans (43; 62; 111); local and rare in the State (62). (Pale basal leaf-bases do not separate this species from *C. Woodii* Dewey; leaf-bases may be either pale brown or purple. Also, the sheath-orifice may be either concave or truncate, and ampliate or nonampliate; these characters do not afford good separation from *C. Meadii* Dewey. The three species, however, seem quite distinct otherwise—70).

C. prasina Wahl. More frequent than indicated. MADISON: wet woods, Sunset L., s. of Oneida, *H 11657*; Cowaselon woods, *R. L. Crockett* (S); CAYUGA: ravines near Owasco L., *A*; West hill, Moravia, *A*; CORTLAND: springy place, Kenney Ck valley, Truxton, *W*; CHEMUNG: moist upland woods, Mt Zoar hill, *L* (E); Ashland, *L*; brookside, Laurel hill*; swaly meadow, Horseheads flats*; STEUBEN: mucky woods, Caton Sw., *S 2081*. Frequent in Tompkins co. (111); at 4 other scattered stations in the Finger Lakes region, hitherto (62); at Apalachin (15) and Slaterville Sw. (111) in the Susquehanna proper, up to now; reported as rare in the Chemung region (14).

C. aestivalis M. A. Curtis. Very rare. CAYUGA: Dresserville gulf, town of Sempronius, *A*; woods, Four-Town schoolhouse, Sempronius, 3 mi. e. of Moravia, *A*. 2 stations in Otsego co. and a few other localities southeastward in the State (62); s. of Slaterville Springs (111); frequent in the Allegany State Park region to our west (65).

C. virescens Muhl. Infrequent. CAYUGA: Parsons ravine, nw. of Moravia, *A*; West hill, Moravia, *A*; TOMPKINS: dry bank, Slaterville Sw.*; CHEMUNG: abundant on Laurel hill, *C*; dry woods, Park hill*; SCHUYLER: ledges, ravine s. of Cayuta L., *W 9474*; YATES: Penn Yan, *H. P. Sartwell*. In Onondaga co. (22); at Ovid and Montezuma, northward in the Cayuga basin (111) and at 6 other Tompkins co. stations, southward; previously only at Summit marsh in the Susquehanna valley (111); not otherwise reported from our territory, earlier reports apparently referring to *C. Swanii* (Fern.) Mack.

C. complanata Torr. ssp. **hirsutella** (Mack.) Clausen (*C. triceps* var. *hirsuta*; *C. hirsutella*—10). Local. CHEMUNG: dryish banks and slopes, n. of Seven Acres pond*, Laurel hill*, Sullivan hill* and

Mt Zoar*; swaly edge of old millpond, Erin*. Sylvan Beach (59); on Utt Pt and at 6 Tompkins co. stations in the Cayuga basin (111); frequent in Tioga co. (26); reported from Elmira (14); near Waneta L. and on Bull hill (10); at Penn Yan (85); generally frequent to common in the State, although somewhat rare westward (62).

C. limosa L. Rare. OSWEGO: Long Bridge pond, Williamstown, *W. W. Rowlee*; MADISON: Castle Sw., s. of Oneida, *H 14118* (S); CHENANGO: open bog on e. side Mud pond, about 2 mi. n. of Union Valley, *C & J. L. Edwards 2597*; TIOGA: sphagnum bog, Oakley Corners, *H. M. Mapes*. 5 Scattered stations about Cayuga L. (111); only Pond brook cited by Clute (14), but later considered locally common in the Susquehanna drainage proper (82); more common northward in the State (62).

C. paupercula Mx. Rare. MADISON: marsh near N. Brookfield, *H 17591*; CORTLAND: Labrador Sw., Truxton, *W*; TOMPKINS: Woodwardia Sw., *H. H. Whetzel 18738*. Pecksport (58); Pompey hill (43); in bogs at Freeville, W. Junius, and near Duck L. (111); likewise more common northward in the State (62).

C. pauciflora Lightf. Rare. MADISON: Lost L., Brookfield, *R. L. Crockett* (S); WAYNE: Galen, *H. P. Sartwell* (B); CHENANGO: open bog, s. end of Mud pond, about 2 mi. n. of Union Valley, *C & J. L. Edwards 2595*; CORTLAND: bog in Labrador Sw., Truxton, *W*. Onondaga co. (22); reported from Junius and the McLean region (111); new to the Susquehanna in N. Y.; frequent or common in the north of the State, but less so southward (62).

C. folliculata L. Very rare in the upper Susquehanna. CHENANGO: Bliven's pond, McDonough, *Wr, Wr, & G. B. Upton 11697*. Oneida L. (59); 6 stations from Ithaca to McLean (111); reported from Carmalt L. in the Susquehanna drainage (15); more or less common elsewhere in the State (62).

C. Schweinitzii Dewey. Rare and local. MADISON: Oriskany Ck, *R. L. Crockett* (S); CAYUGA: Poison Oak Sw., Dresserville, *A*; Hall's Sw., Dresserville, *A*; TOMPKINS: marshy place where small springy brook enters Ck, Van Buskirk glen, *Al 19846*. Previously known from Beaver Bk, Tompkins co. (111); frequent in central N. Y., but less common westward (62); unknown from the upper Susquehanna in N. Y., except for Spencer L. (111).

C. Pseudo-Cyperus L. Rare. ONONDAGA: swamp near Fabius, *G. P. & F. L. Van Eseltine 2839* (S); Manlius, *W. M. Smith* (S); Tully, *G. F. Hastings*; CHEMUNG: mucky, marshy thickets n. of Seven Acres pond, *S 911*. Pecksport (57); Onondaga Co. (43); 3 n. stations for the Cayuga basin (111); Summit L., Otsego co. (85); Pond brook (14); Campville (26); Spencer L. (111); Big Flats (14); Penn Yan (85); also at Utica, Oswego, Pine Plains and Bergen Sw. (62).

C. trichocarpa Muhl. Local. MADISON: Morrisville, *L. M. Underwood* (S); CORTLAND: rr. ditch, Truxton, *W*; CHEMUNG: forming swales, mucky borders of Beaver Bk, Horseheads, *S 1409*; ONTARIO: Penn Yan, *H. P. Sartwell*. Onondaga co. (22); frequent in Tompkins co. (111); not rare in Broome co. (14); abundant along the river in Tioga co. (26); rare elsewhere (62); new to the Chemung.

C. squarrosa L. Rare and local. CHEMUNG: open swaly clearing in white oak woods, Comfort hill, *S & H. Scudder 934*; a few clumps in alluvial thicket about ½ mi. w. of Wellsburg, *S 1536*. Otherwise reported for our area only from Clay (43) and Chemung (15). Apparently rather frequent eastward in the State, in the Hudson valley and near-by highlands, judging from records (62) and specimens; scattered across the State (62).

C. vesicaria L. (incl. var. *monile*—70). Occasional and locally plentiful. ONONDAGA: swale at head of Crooked L., Tully, *W 1943*; CHENANGO: abundant in Greene meadows*; CORTLAND: Nott pond, river flats, Truxton, *W*; CHEMUNG: tufts, swaly borders of pond, n. edge of Red Jacket Sw., *S 1506*; swale s. of Latta brook*; YATES: Dundee, *S. H. Wright*. Onondaga co. (22); Moravia (20); at Pout pond (111); 4 stations in the upper Fall Ck drainage (111); at Franklin, Slaterville Sw. and the Cortland marlponds in the Susquehanna (14; 111); common in Tioga co. (15); common northward, but much less so, westward in the State (62).

C. Tuckermani Dewey. Locally abundant (62). ONEIDA: Marshy borders of Oneida L., Lenox, *J. V. Haberer 3935*; MADISON: e. of Peterboro, *R. L. Crockett* (S); Morrisville, *L. M. Underwood* (S); ONONDAGA: Tully, *G. F. Hastings*; CAYUGA: swamp, head of Owasco L., *A*; swampy woods, Sempronius, *A*; Venice, *A*; CORTLAND: river flats, Truxton, *W*; TOMPKINS: hilltop swale on University plot, Newfield, *M et al.*; CHEMUNG: mucky thickets n. of Seven Acres pond, *S 913*; low swale near Erie rr. bridge, Seely Ck., Elmira, *L* (E); wet swales in low open woods n. of Horseheads, town of Veteran, *L* (E); swale, Ring Jct.*; swale s. of Latta brook*; YATES: Penn Yan, *H. P. Sartwell*. Onondaga co. (22); near Clyde and 6 Tompkins co. stations in the Cayuga basin (111); not too rare in the upper Susquehanna (14); common in Tioga co. (26).

Arisaema Dracontium (L.) Schott (*Muricauda Dracontium*). Scarce. ONONDAGA: s. end of Cross L., *M. E. Faust* (S); CHEMUNG: rich woods, Cayuta Ck, n. of pipeline, *S 2014*; alluvial base of Cobble hill*; alluvial thickets, Hoffman's pond, *H & W. Scudder*, specimens not preserved; river bottom woods, Chemung narrows*. Rockwell Springs (43); scarce in the Cayuga basin (111); frequent (26) to plentiful (14) along the Susquehanna proper; rare in the Chemung (14), whence reported only from Wellsburg (69); infrequent across the State (62).

Juncus Dudleyi Wiegand. Generally infrequent, but rather common where soils are more or less calcareous. ONEIDA: edge of marsh, 2 mi. sw. of Sangerfield, *H 17612*; MADISON: Oriskany Ck, *R. L. Crockett* (S); Page camp, *R. L. Crockett* (S); ONONDAGA: small Tully L., *W & W 274*; marshy soil in open field about 1 mi. e. of N. Syracuse, *M. E. Underwood 38* (S); hillside slough, 1½ mi. s. of Marcellus, *G. P. Van Eseltine 3833* (S); damp roadsides s. of Howlett hill, w. of Split rock, *N. Hotchkiss 666* (S); swale near Oran, *G. P. Van Eseltine 3108* (S); OTSEGO: roadside swale n. of Summit L., *M & Cu 5043*; TOMPKINS: dripping ledges by bridge, Judd Falls road near Cornell U. campus, *S 1612* (B); clay roadside bank, West hill, Ithaca, *S, Al, et al. 19366;* wet meadow, crest of West hill, *A. Gershoy 7825*; CHEMUNG: moist pasture near Lowe's pond, *S 133*; Sullivan hill, *L* (Bu); SCHUYLER: streambank s. of Perry City, *A. Gershoy 9562*; roadside swale s. of Mecklenburg, *A. Gershoy 9561*; STEUBEN: about edge of marl pond, 1 mi. w. of Atlanta, *C et al. 2693.* Locally common (111) to locally abundant (62) in the region; newly reported s. and w. of Ithaca.

J. balticus Willd. var. **littoralis** Engelm. Very rare. TIOGA: small swamp near Waverly, *F. E. Fenno* (A); CHEMUNG: in shallow water over an area of considerably more than an acre, Red Jacket Sw., *S et al. 1518.* Considered scattered or local throughout the Finger Lakes region and in the Southern Tier (62); these 2 collections are all found by the writer from the latter area.

J. Torreyi Coville. Scarce. MADISON: moist fields, 2 mi. nw. of Oneida, *H 25237*; ONONDAGA: Syracuse, *R. L. Crockett* (S); TOMPKINS: weedy area, mouth of Williams brook, *S 1217*; clay roadside bank across from Old Stone house, road to Trumansburg, *S, Al, et al. 19372*; field e. of rr., just s. of Lick brook, Inlet valley, *W 17362*; shore of Cayuga L., near Ithaca airport*. Scattered throughout the State (62); head of Oneida (59) and shores of Onondaga (43) lakes; 3 widely separated stations previously cited for the Cayuga basin (111).

Smilacina stellata (L.) Desf. (*Vagnera stellata. Smilacina* Desf., nom. cons.—7). Rare in the upper Susquehanna, or possibly not collected. ONONDAGA: swamp near n. end of Crooked L., Tully, *W 1995*; OTSEGO: marsh at Mud L., Fly Ck. *S. H. Burnham;* CHENANGO: alluvial soil along s. side of Chenango R., Greene, *M et al. 15327*; CORTLAND: on Lehigh Valley rr. bank n. of county line, Cortland Twp, *W & A. R. Bechtel 7863*; CHEMUNG: alluvium along Cayuta Ck. Rodbourn*; ALLEGANY: damp hillside, Crosby Ck, sw. of Almond, *L. F. Randolph 9626.* Otherwise reported only from Summit L., Otsego co. (85), in the Susquehanna drainage, although frequent elsewhere in the State (62; 111); new to the Chemung valley.

S. trifolia (L.) Desf. (*Vagnera trifolia*). Unusual southward. SCHUYLER: marsh on the Cayuga-Seneca watershed, Hector

Twp, *Al 18497*. "In nearly all of the cold sphagnum swamps and bogs of central New York. Rare southward .... and westward." Hitherto reported for the Cayuga basin from 3 stations at the n. end and from Enfield (111); only at Preston, Chenango co., in the upper Susquehanna valley (14).

Disporum lanuginosum (Mx.) Nichols. Local, but perhaps overlooked. CORTLAND: South hill, Cortland, in moist woods, *S et al. 1179*; TIOGA: rich woods, state reforestation area 1, *S 736*. At Auburn and Penn Yan (85); 12 stations in Tompkins co. (111); Oxford, Binghamton and Kirkwood previously cited for the upper Susquehanna (14); rare (62) from our territory, westward; apparently new to Cortland and Tioga counties.

Dioscorea villosa L. Rare. TIOGA: river bottom thicket, Barton*; CHEMUNG: moist thickets, bank of Chemung R., opposite Bohemia, *L* (E); wood near old state fairgrounds, *L* (E); moist thickets, Beaver Bk, Horseheads, *S & A. K. Rosecrans 111*; alluvial thicket, base of Cobble hill, *S 1058*. In the region from Broome to Chemung co., abundant eastward, gradually decreasing in frequency towards the west (14); at Owasco L. (85); elsewhere in the State only in the southeastern and southwestern portions (62).

Sisyrinchium mucronatum Mx. Locally abundant. CHEMUNG: sandy thickets, Sullivan hill, *S 1145*; grassy bank along rr., Bowman hill, *S 779* (albino); wet meadows along Beaver Bk, *S 1408* (flowers divers shades of blue, indigo and purple; culms from less than 5 cms. tall in dense tufts to 20 cms. in few-culmed plants); Wellsburg flats, *F. Benedict* (specimens observed in garden); STEUBEN: vicinity of Campbell, *G. D. Cornell* (incl. albino) (C1). Locally reported only from Ithaca cemetery (20); frequent in the State, at least southward (62).

Orchis spectabilis L. (*Galeorchis spectabilis*). Infrequent. MADISON: Morrisville, *L. M. Underwood* (S); ONONDAGA: Howlett's gorge, *M. L. Overacker* (S); CAYUGA: hill ravine sw. of Owasco L., *W. W. Rowlee*; OTSEGO: Plainfield, *S. A. Brown*; CORTLAND: Jones' woods, *W*; TOMPKINS: ravine-bottom, Van Buskirk glen, *S & Al 19979*; CHEMUNG: rich woods, MacDuffy Hollow*, Erin*, Laurel hill*, Millport run*. Not uncommon in the Cayuga basin (111); somewhat rare in the upper Susquehanna (14); locally common northward in the State, but less frequent or rare southward and westward (62).

Habenaria lacera (Mx.) R. Br. (*Blephariglottis lacera*). Scarce to locally common. CAYUGA: low fields n. of Spring L., *E & MacD 6249*; TOMPKINS: swale near Slaterville Sw., *S 658*; TIOGA: swampy place, 4 mi. n. of Barton, *C & H Trapido 2677*; peat bog, Owego, *H. M. Mapes*; peat bog near Oakley Sw., *S & R. Ladue* (B); SCHUYLER: swampy woods, Camp Gorton, *C 427*. Infrequent, but scattered, in the Cayuga basin (111); rare in the

Susquehanna valley, whence otherwise definitely reported only for 3 eastern stations in N. Y. (14; 15); frequent or common elsewhere in the State (62; 113).

H. orbiculata (Pursh) Goldie (32). (*Lysias orbiculata,* incl. *L. macrophylla*—111) Rare and local. CAYUGA: Moravia, *anon.*; CORTLAND: dry chestnut woods, Mt Toppin, Preble, *W*; n. Harford Twp, *Wr & Wr 15052*; TOMPKINS: w. of Dryden L., *Wr 13473*; Lloyd Cornell Wild Flower Preserve, *M 16513*; Danby, *W. R. Dudley*; CHEMUNG: hilltop, Van Etten, *E & MacD 7934*; dry knoll, Rodbourn marsh*. Infrequent (62; 111); heretofore reported only at Barton (15); the region of N. Spencer (111), and Cinnamon L. (14), w. of Broome co. in the Southern Tier, although considered common eastward (14).

H. flava (L.) Gray var. **virescens** (Muhl.) Spreng. (*Perularia flava,* as to common northeastern race). Scarce to locally abundant. CHENANGO: Greene Meadows, *S & D 1152*; CORTLAND: moist pine plantation, state reforestation area 3*; TOMPKINS: abundant in grassy swales near ponds or brooks, Slaterville Sw., *S & J. Langan 1281*; swale, se. Dryden Twp*; CHEMUNG: thicket between 2 old fields, Langdon hill, *S 555*; border of old hill field near thickets, Laurel hill, *S 926*. Syracuse and near Oneida L. (55); Clay (43); 2 other stations at the n. end of the Cayuga basin and 10 at the s. end (111). Infrequent across the southern part of the State, although frequent northward (62); new to the Susquehanna in N. Y., with the possible exception of the Bald Hill station (111).

H. clavellata (Mx.) Spreng. (*Gymnadeniopsis clavellata*). Rare. CHENANGO: McDonough, *F. V. Coville*; BROOME: sphagnum bog at Killawog, *Wr, Wr, & G. B. Upton 11822*; SENECA: Lodi, *N. W. Folwell*; TOMPKINS: Malloryville bog *E 15353*; a few plants on fallen logs, Slaterville Sw., *S 964*; TIOGA: peat bog, Oakley Corners Sw.* Frequent in central N. Y., but less so or rare westward (62); from Ringwood to McLean and at the n. end of Cayuga L. (111); also reported from Pond brook, Oxford, and Barton in the Susquehanna (14).

Pogonia ophioglossoides (L.) Ker. Scarce in the upper Susquehanna. CHENANGO: tamarack swamp, Preston, *F. V. Coville*; Brisbin Sw., ex herb., *H. L. Stewart*; CORTLAND: bog, se. end of Labrador Sw., *W*; Little York, *R. Jones 7946*; TIOGA: Oakley Corners Sw., *H. M. Mapes*. About Oneida L. (59); Cazenovia (55); about Syracuse (43); infrequent in the Cayuga territory (111); near Little York (63); previously only from Binghamton, Mutton Hill pond, and Barton at the west, although more common eastward in the Clute region (14; 26).

Spiranthes Romanzoffiana Cham. (*Ibidium Romanzoffianum. Spiranthes* L. C. Richard, nom. cons.—7). Rare. MADISON: moist embankment below dam, Tuscarora L., Erieville, *M & Cu 5186*; marl bog, Woodman pond, *M & Cu 5185*; Rippleton Sw.,

Cazenovia, *W*; OTSEGO: sedge bog, Summit L., *M & Cu 5184*; CORTLAND: sphagnum, Labrador bog, Truxton, *W*; TOMPKINS: marly springy field, edge of Malloryville bog, *E. Dean & C. C. Thomas 3853*. Central Square (43); e. Tompkins co. and the W. Junius bogs in the Cayuga basin (111); only at Summit marsh in the Susquehanna drainage, heretofore (111); local or somewhat rare southward and westward in the State (62).

S. gracilis (Bigel.) Beck (*Ibidium gracile*). Infrequent (14; 26; 62; 111) CAYUGA: dry banks, border of woods, Dry Ck ravine, Fillmore glen, *A*; CHEMUNG: near Fitch's bridge, *L* (Bu); in dense underbrush, Laurel hill, *S 560*. Rare in the Southern Tier (62).

Goodyera tesselata Lodd. (*Epipactis tesselata*; *Peramium tesselatum. Goodyera* R. Br., nom. cons. prop.—7). Rare. ONONDAGA: damp soil, Fayetteville, *W. R. Dunlop*; CHEMUNG: old woods, rich and shady, Sullivan hill, *L* (E). Onondaga co. (22); 3 Tompkins co. stations cited for the Cayuga basin (111); rather rare westward in the State (62).

G. repens (L.) R. Br. var. **ophioides** Fern. (*Epipactis repens* var. *ophioides*; *Peramium secundum*). Rare. ONONDAGA: Eagle cliff, Tully, *G. F. Hastings*; SENECA: Lodi, *N. W. Folwell*; CHENANGO: rich woods, w. shore of McCall's pond, Preston, *W 6289*; TOMPKINS: Freeville, *anon.*; YATES: Penn Yan, *T. Marshall Fry* (G). Rare hereabouts (14; 62; 111); infrequent in Tioga co. (26).

Listera australis Lindl. (*Ophrys australis. O. insectifera* L. has been proposed as type of the genus; orchids congeneric with the present are referable to *Listera* R. Br., nom. cons.—7). Rare and local (62; 111). CHENANGO: Bliven pond near McDonough, *H 15837* (1928) SENECA: sphagnum n. of transmission line, Junius, *E 16937*. ONEIDA: W. Vienna, *H 17763* (1930); New London, *M. S. Baxter* (1924). Cited for the region from Pecksport (62), Cicero Sw. (43), Baldwinsville (53), Duck L., and Featherbed bog (111); unknown from the Susquehanna drainage. Local in the State (62).

Liparis liliifolia (L.) L. C. Richard. Rare. TOMPKINS: maple woods on slope, Michigan Ck, 1 mi. n. of Tompkins co. line, Danby, *Wr 17770*. Reported from Verona and near Ovid (85), Oneida (53), Onondaga co. (43), Renwick slope (111) and near Elmira (15); not common in the State (62).

Malaxis monophylla (L.) Sw. var. **brachypoda** (Gray) Morris & Eames (*M. monophylla*; *Microstylis monophyllos*—3). Unusual. CAYUGA: wet moss, rocks near Montville, Moravia, *M. F. Merchant*; damp shale rock, Dry Ck, Fillmore glen, *A*; SCHUYLER: moist sloping bank, Watkins, *E. J. Durand;* also Sayre, Pa. *E. J. Winslow* (G). Rare, local, or scarce (14; 62; 111) with us.

M. unifolia Mx. (*Microstylis unifolia*). Rare, but probably overlooked. OTSEGO: W. Bainbridge, *Wr 11860*; CHENANGO: Bliven's pond, McDonough, *Wr, Wr, & G. B. Upton 11862*; BROOME: sphagnum bog, Killawog, *Wr, Wr, & G. B. Upton 11861*; TOMPKINS: 4 mi. s. of Dryden, *Wr & Wr*; 1.2 mi. nw. of Etna, *W. Blaser 18785*; on a high hill, Fall Ck, Ithaca, *N. W. Folwell*; TIOGA: dry woods, Oakley Corners, *H. M. Mapes*; CHEMUNG: rich upland woods, w. slope of Park hill, *S 566*; acid hill thicket, Laurel hill, *S 927*; dry woods, Langdon hill*. Carpenter's pond (56); 3 e. stations cited for the Cayuga basin (111); Oxford (14); South Pinnacle, Caroline (111). Seen by the writer only in association with hemlocks.

Corallorrhiza trifida Chat. (*C. Corallorrhiza*). Local. MADISON: Morrisville, *L. M. Underwood* (S); Cazenovia, *M. L. Overacker* (S); ONONDAGA: n. end of Labrador L., *W. E. Manning 15054*; SENECA: vicinity of Lodi, *N. W. Folwell*; CHENANGO: deep swampy woods n. of Mud pond, about 2 mi. nw. of Union Valley, *C & J. L. Edwards 2601*; CORTLAND: Labrador Sw., Truxton, *W*; TOMPKINS: hemlock woods, Malloryville bog, *M 16508*; TIOGA: Headwaters Sw., *M 16507*; wet woods, Oakley Corners bog*; CHEMUNG: rich, dry, deciduous woods, N. Van Etten Sw., *E & MacD 3856*; in sphagnum. Rodbourn marsh*; Laurel hill, *fide Clausen*; SCHUYLER: Arnot Forest, *M 17178*. Baldwinsville and Syracuse (53); 4 other swamps in Tompkins co. (111); Oxford (14) and Slaterville Sw. (111) the only older records for the upper Susquehanna in N. Y.; "less common or rare southward" in the State (62).

C. odontorrhiza (Willd.) Nutt. Local and rare. CAYUGA: woods and bogs, Duck L., Conquest, *Wr & Wr 13484*. Elsewhere in our region, in Onondaga co. (43; 62); about Oneida L. (59); reported from 3 widely separated stations by Wiegand and Eames (111), Richford being in the upper Susquehanna; not cited from w. of Apalachin by Clute (15), although common eastward; considered infrequent by Fenno (26); Yates co. (20).

Salix serissima (Bailey) Fern. Rare. CAYUGA: Halls Sw., Dresserville, *A*; CHEMUNG: low bushes in shallow water, Red Jacket Sw., *S et al. 1422*. Otherwise reported for our region from Onondaga co. (22), Crusoe L., W. Junius, and McLean (111); still unknown in N. Y. outside of the greater St Lawrence drainage.

S. candida Flügge (incl. var. *denudata* Anders.). Rare southward. ONONDAGA: swampy shores of Labrador pond, Apulia, *W*; Tully, *G. F. Hastings*; CORTLAND: near Beaver Bk, not far n. and w. of fish hatchery, *W 18506*; Labrador Sw., Truxton, *W*; CHEMUNG: small shrubs in shallow water, Red Jacket Sw., *S 1621*; YATES: Dundee, *S. H. Wright* (S). Considered frequent in the central and western portions of the State (62); probably frequent at n. end of Cayuga L., fide Clausen but known only from a meadow s. of Ithaca at s. end (111); Summit L., Otsego co. (85); marly

areas in Steuben co. (10). Material of var. *denudata Anders., S et al. 1419a,* has been collected from the same shrub as var. *typica, S et al. 1419.*

Myrica pensilvanica Loiseleur (*M. carolinensis* Auct., non Mill. —37). Rare. ONONDAGA: swamp at s. end of Mud pond e. of Marcellus, *N Hotchkiss 676* (S); Kirkville, *L. M. Underwood* (S); Riegel's Sw., *H. H. White* (S); s. side of White lake, fide Faust; TOMPKINS: dry knoll, Carter Ck*. Hitherto reported from Peterboro (62), Onondaga co. (22), the bogs at the n. end of the Cayuga basin (111), Summit L., Otsego co. (85), and Headwaters Sw., Tompkins co. (111) for our territory.

Betula populifolia Marsh. Rare southward in our region. TOMPKINS: old field near Slaterville Sw., *S 1351,* possibly seeded from cultivated trees, although none have been noted near-by. Very common eastward in the Susquehanna drainage and s. of our limits (14); common in central N. Y., although rare in the highlands there and westward (62), whence definitely reported only from s. of Owego (27); not previously reported from the Cayuga basin.

B. nigra L. Very rare. CHEMUNG: swamp near Lowman, *L* (A). Previously reported for our region only from Fish Ck (85) and Seneca R. (43); Deerfield Ck (85). In the lower Hudson valley and on the coastal plain (62).

Alnus rugosa (Ehrh.) Spreng. (111) (*A rubra,* non Bong.— 112). Unusual. BROOME: shore of Lily L., *M & Cu 5189.* Hitherto reported from Oneida L. (59), Onondaga co. (43), the Cayuga shores (111), Cayuta L. (111), and Mutton Hill pond (15) for our region; common outside (62).

Arceuthobium pusillum Peck (*Ramouzofskya pusilla. Arceuthobium* Bieb., nom. cons.—7). Local in central N. Y. ONONDAGA: bog e. of Labrador pond, *C 2132*; Cicero bog, in dense sphagnum, *M. C. Wiegand 6344*; CORTLAND: Labrador Sw., Truxton, *W.* Known from Onondaga co. (22), Junius (111), and Chenango co. (14); somewhat rare or local southward in the State (62), its frequency probably limited by the rarity of *Picea mariana* (Mill.) BSP., its usual host.

Polygonum cilinode Mx. More common than previously supposed. ONEIDA: thickets ne. of W. Vienna, *H 17761*; MADISON: Brookfield, *Prosser*; ONONDAGA: dry scrubby crests and ledges, hilltop e. of Labrador pond, *W 9848*; CHENANGO: near Bliven's pond, McDonough, *Wr, Wr, & G. B. Upton 11992*; TIOGA: gravelly bank w. of Richford*; CHEMUNG: roadside thickets, Rodbourn marsh, *S 352*; gravelly roadside banks s. of Pine Valley, *S & H. Scudder 1455*; open woods, Langdon hill*; dry roadsides, Post Ck* and nw. Catlin Twp*; SCHUYLER: abundant along the roads near Monterey*; STEUBEN: Woodhull, *B. B. Stroud* (Bk); vicinity of Campbell, *G. D. Cornell* (Cl); roadsides and

thickets, jct. of Chemung, Schuyler and Steuben counties*. Previously reported from Jamesville (43), Cortland co. (111), Coville's region, presumably Chenango co. (14), w. of Owego (26), and nw. of Richford (10); rare in the western part of the State (62). Still unknown in the Cayuga basin. Locally abundant in roadside thickets and stonerows on the higher hills s. of the state line*. The plants often appear on newly disturbed ground, as the writer is informed is the case in the Adirondacks.

Chenopodium capitatum (L.) Asch. Local. MADISON: vicinity of Hamilton, *W. F. Langworthy 72*; ONONDAGA: roadside, Tully, E *16114*; near Syracuse, *I. Beverly* (S); Manlius, *W. M. Smith* (S); CAYUGA: dry rich ground, Summer Hill, *A*; Morse's Mills, Sempronius, *Wr 9849*; near Union Springs, *anon.*; CORTLAND: rr. e. of Little York, *W*; SCHUYLER: road in Arnot forest, *Al & L. Cox 19999*. Infrequent in the highlands of the State and in the St Lawrence valley (81); definitely reported for our region, heretofore, from Onondaga co. (22), 5 stations in the se. portion of the Cayuga valley (111), Otsego co. (85), Mulhoellen (4) and Penn Yan (62).

Ranunculus fascicularis Muhl. 1 new station. SCHUYLER: woods on ledges, se. corner, Seneca L., *W 17881*. Reports as frequent or common may be due to confusion with *R. hispidus Mx.* in early reports (14; 15). Definitely known from 2 other localities in our region: Onondaga co. (22) and the lake cliffs above McKinneys (111); Tioga co.? (26).

R. flabellaris Raf. (*R. delphinifolius*—62). More common than previously supposed, but still local. CAYUGA: head of Owasco L., *A*; SENECA: Ovid, *N. W. Folwell*; TOMPKINS: swale and pools, Myers Pt, *M & C 18327*, *18328* (the latter double-flowered); in about 6 in. of water, Slaterville Sw., *S 744*; TIOGA: pond along Candor Ck, *Bowman 17880a*; CHEMUNG: several kettle ponds in Red Jacket Sw., *S 1432*; ONTARIO: Gorham, *H. P. Sartwell*. Near Oneida and Onondaga lakes (62); scarce in the Cayuga basin (111); Seneca L. and Penn Yan (20); rare in the Susquehanna drainage, proper (14; 82; 111); cited only from L. Lamoka for the Chemung (72); infrequent in the State (62).

Thalictrum revolutum DC. Rare. ONONDAGA: s. of Syracuse, *M. L. Overacker* (S); SCHUYLER: wooded cliffs, se. corner of Seneca L., *W 17884*. Also reported from Oneida (62), Long Branch (43), near Pout pond (111), Esty's (111), Mt Prospect (14), and Harrington's ford (14) for our territory. Also in the Hudson valley and on near-by highlands; on the coastal plain (62); Irondequoit bay (60).

Adlumia fungosa (Ait.) Greene. Rare or local. ONONDAGA: Syracuse, *L. M. Underwood* (S); Howlett's gorge, *M. L. Overacker* (S); OTSEGO: woods n. of Cooperstown, *J. V. Haberer*; CHEMUNG: "now found near Roericke's glen, 1897" (annotation on

sheet of cultivated material, *L* (E); SCHUYLER: dryish rocky cliffs s. of Watkins, *S 970*; STEUBEN: Rathbone, *B. B. Stroud* (Bk); "said to be found at Addison" (annotation on label of Lucy specimen). Infrequent or local across the State (62); previously reported from Oneida, Jamesville, and Junius at the n. end of the Finger Lakes region (62); from the Ithaca and Watkins locales at the so. end (111); from Otsego (85) and Tioga (15) counties in the Susquehanna drainage in N. Y.

Corydalis sempervirens (L.) Pers. (*Capnoides sempervirens. Corydalis* Medic., nom. cons.—7). Rare and local. SCHUYLER: along wood-road, Arnot Forest, *S 291*. Onondaga co. (43); Beebe L., Cornell U. campus (111); 3 localities cited by Clute (14) for N. Y. State; Sayre just across the line (15); less frequent or rare westward in the State (62).

Arabis glabra (L.) Bernh. Rare. ONONDAGA: roadside n. of Split rock, *G. P. & F. L. Van Eseltine 2709* (S); CAYUGA: Kelloggsville, meadow, *F. L. Kilborne*; near Moravia, *A*; CHENANGO: gravelly hillside, Chenango Forks, *M 17481*; CORTLAND: river flats, Cortland, *W*; TOMPKINS: lawn, Baker Laboratory, Cornell U. campus, *S. H. Burnham 18555* (depauperate); old field near C.C.C. Camp S-125*; CHEMUNG: rich woodland, n. of Fairgrounds, *L* (E); STEUBEN: roadside bordering dense woods, Caton Sw., *S 2070*. Occasional or frequent in the State (62); Oneida L. (59) and Onondaga co. (43), northeastward in our region; scarce in the Cayuga basin, where mostly at the s. end (111); tolerably common eastward in the Susquehanna valley (14), but reported only from Apalachin (15), Summit marsh (111) and Elmira (15) at the west.

Parnassia glauca Raf. (*P. caroliniana,* non Mx.—109). Local or rare. MADISON: marly shore, Woodman pond, *M & Cu 5220*; CAYUGA: wet banks, Moravia, *A*; CHEMUNG: Red Jacket Sw., *S 1643*. Locally common (62); Onondaga co. (43); frequent in the ravines and bogs of the Cayuga region (111); at Port Crane and near Waverly in the upper Susquehanna (14).

Ribes glandulosum Weber (*R. prostratum*—17; 18). Rare. MADISON: Morrisville, *L. M. Underwood* (S); OTSEGO: marsh at Mud pond, Fly Ck, *S. H. Burnham*; CHENANGO: in pasture near Maybury, *M et al. 15573*; CHEMUNG: hemlock-sedge bog, Rodbourn marsh, *S 946*. Definitely reported for the Finger Lakes region, hitherto, only from Oneida L. (59), Tamarack Sw., Syracuse (43), and swamps at the lower end of the Cayuga basin (111); from Barton (26) and Slaterville Sw. (111) in the upper Susquehanna.

R. hirtellum Mx. Locally abundant. ONONDAGA: swamp near n. end of Crooked L., Tully, *W 2450*; OTSEGO: marsh at Mud L., Fly Ck, *S. H. Burnham*; CHEMUNG: abundant in Red Jacket Sw.*, incl. some heavily pubescent colonies—var. *calcicola*

(Fern.) Fern. Common northward across the State, rare or local southward and westward (62); Onondaga co. (43); frequent in the Cayuga basin (111); hitherto not reported from the upper Susquehanna.

Spiraea latifolia (Ait.) Borkh. Rare in the Chemung valley. CHEMUNG: escaped, roadside, Hoffman st., Elmira, *L* (E); STEUBEN: Bath, *J. G. Webster* (Cl). Not reported by Clute and Fenno, but probably included in the comprehensive *S. salicifolia* L., only at Chicago bog and grotto in the Cayuga basin (111); about Oneida L. (59); common in parts of Cortland and Tioga counties. At 1 station in Niagara co., to our west, where thought introduced (113).

Potentilla fruticosa L. Scarce, but locally abundant. TOMPKINS: marl-spring near Ck, sw. of Newfield village, *E & W. 12219*; CHEMUNG: single bush in hill swale, Laurel hill, *S 953*; shrubs scattered, or in places forming extensive stands, through several acres in Red Jacket Sw., *S 1416*; STEUBEN: talus-slope, n. side large ravine, w. side of Hammondsport, *C & W. C. Wilson 1641*; Hammondsport, *G. R. Youngs* (S). Scarce in the Cayuga basin (111); rare in the Susquehanna (62), whence, up to now, definitely reported only from near Cooperstown (85), near Little York (63) and at Summit marsh, Tioga co. (111); Yates co. (20); more common northward in the State (62; 81).

P. palustris (L.) Scop. (*Comarum palustre*). Locally rare. MADISON: vicinity of Hamilton, *W. F. Langworthy*; SENECA: swamp, Covert, *N. W. Folwell*; OTSEGO: bog, Summit L., *M & Cu 5231*; STEUBEN: bog, w. end of Cranberry L., *R. McVaugh & Cu 7439*; boggy shore of Peterson L., 3 mi. ne. of Savona, *R. McVaugh & Cu 7479*; edge of Caton Sw., *S 2064*. About Oneida L. (54); Apulia (43); infrequent in the Cayuga area (111), where known only from McLean n. to Montezuma, thence w. to Junius; previously reported from 9 scattered N. Y. stations in the Susquehanna drainage (14; 15; 20; 26; 85). Common to the north of our area.

Geum macrophyllum Willd. Very rare. CHEMUNG: ditch, base of rocky wooded slope, n. of Horseheads, *S 1033*. Rare in the northern Adirondacks (62); also in Onondaga co. (43) and at Penn Yan (20) outside; unknown elsewhere in the State.

Sanguisorba canadensis L. Rare, but locally abundant. MADISON: Nine Mile Sw., Sangerfield, *M & Cu 5236*; CAYUGA: Little Bear Sw., *A;* WAYNE: s. of Mud pond, Conquest, *Wr & Wr 13674*; SENECA: Vandemark pond, *S. H. Burnham et al. 17595*; CHEMUNG: springy bank by rr., se. Catlin Twp, *W 12280*; mucky flats and sedgy swales, Horseheads, *S 1027*; STEUBEN: wet meadow, Wayne, *J. G. Webster* (Cl). Abundant in the Horseheads-Catlin-Veteran region, plants even occurring on the dry cindered rr. banks, where they are shorter, stockier and markedly pubescent.

Fish Ck. (85); about Oneida L. (54; 56); Kirk park, Onondaga co. (43); L. Como and 3 Tompkins co. stations listed for the Cayuga basin, up to now (111); Victor, Ontario co. (20); 3 scattered stations in the Susquehanna valley, heretofore (14). Local in the State.

Prunus Susquehanae Willd. Very rare. CHEMUNG: talus-slope, Chemung narrows, *S & D 1131.* First station for its home drainage system in N. Y. South hill, Ithaca, and 4 other widely separated districts in the State (62). (Also Athens, Pa., not far from our new station—15).

Astragalus Cooperi Gray (*Phaca neglecta*; *A. neglectus*, non Freyn—101). Rare and local. CAYUGA: gravelly se. shore of Owasco L., *A*; SENECA: vicinity of Lodi, *N. W. Folwell;* ONTARIO: Black Pt, Canandaigua L., *Mrs E. P. Gardner.* Also on slopes of Onondaga L. (85); Otisco (43); on a few ledges on the e. shore of Cayuga L. (111). Otherwise unknown from our territory and rare even westward (62).

Desmodium rotundifolium DC. (*Meibomia Michauxii*—7, art. 69). Occasional. ONEIDA: oak woods, North Bay, *H 5882*; MADISON: dry woods w. of N. Chittenango, *H 25346*; CAYUGA: dry sandy or rocky woods, Moravia, *A*; TOMPKINS: dry hill woods n. of Slaterville Sw.*; CHEMUNG: gravelly and sandy thickets near Unilar bog, *S 1662*; talus-slope, Mountain House narrows*; dryish woods, e. slope, Mt Zoar*; SCHUYLER: dry woods on hill e. of Waneta L., *C 645.* About Oneida L. (59); Onondaga co. (43); near Auburn (85); scarce in the Cayuga basin, where mostly in Tompkins co. (111); 4 scattered stations in the upper Susquehanna (14; 15).

Lespedeza violacea (L.) Pers. Slightly more frequent. CAYUGA: dry border of copse near Dry Falls, Fillmore glen, *A*; TOMPKINS: near Forest Home, w. of Fall Ck, *R. S. Snell 18365*; CHEMUNG: warm sandy soil, Chemung, *L.* Onondaga co. (43); rare on the ravine ledges and points of Cayuga L. (111); previously reported only eastward in the Susquehanna drainage (14); Penn Yan (85).

Linum virginianum L. Infrequent northward; rare southward. CAYUGA: dry hills, Moravia, *A*; CHEMUNG: open rocky woods, sw. slope of Bowman hill, *S 330*; STEUBEN: on slope of hill e. of Oak Hill, n. side of the Canisteo R., Canisteo Twp, *C & H. Trapido 2708*; YATES: ——, *S. H. Wright,* (S). About Oneida L. (59); Onondaga co. (43); Newton ponds at the n. end and 5 stations at the s. end of Cayuga L. (111); reported from Campville (15), White Church (111), and Painted Post (4) and listed for the lower Cayuta Ck valley (76), making a new total of 6 stations for the upper Susquehanna. Previously listed from roadsides in the Southern Tier (85).

Floerkea proserpinacoides Willd. Probably overlooked. CAYUGA: brookside, Homer gulf, *W 15742*; CHENANGO: river bottom, Norwich, *H. L. Stewart*; BROOME: river bottom thickets, Lisle*; CORTLAND: bog, s. side Labrador pond, *M 14008*; Kenney Ck valley, Truxton, *W*; TOMPKINS: rich bottomland woods just below Varna crossroad, *W & W 2753*; pointed out to the writer by Wiegand in the Six Hundred tract, Slaterville Springs; CHEMUNG: alluvium along brook, Lowman Sw., *S 2006*. Otherwise cited from Oneida L. (59), near Syracuse (43), Auburn (20), 8 stations at the lower end of Cayuga L. (111), and near Watkins Glen (10) for the northern sector of our area; recorded only from the Unadilla valley (85), Cayuta Ck (76), and Wilseyville (10) for the southern.

Rhus copallina L. var. **latifolia** Engler (*R. copallina*, typical, of House—40). Occasional. TOMPKINS: se. of field w. of St Mary's cemetery, s. of Ithaca, *W. W. Rowlee*. Not hitherto reported from the Cayuga basin; near Oneida L. (85); rare in western N. Y. (62); reported from 3 widely separated Susquehanna stations (14; 27; 85) in N. Y., and one just over the line (15).

Rhamnus alnifolia L'Her. Rare in the southern subunit. ONONDAGA: swamp, s. side of Labrador pond, *C 2124*; CORTLAND: moor of Green L., Preble, *W 8443*; CHEMUNG: on tussocks, Red Jacket Sw., *S 1501*; wet woods, Gee Sw.* and Rodbourn marsh*; SCHUYLER: swamp nw. of Alpine, *M & F. B. Wann 14834*; STEUBEN: Wayland Sw., *W 15756*. About Oneida L. (59); Onondaga co. (43); frequent in the Cayuga basin (111); Yates co. (85); previously reported from 5 scattered stations in the Susquehanna drainage (14; 15; 85).

Hypericum boreale (Britton) Bickn. Very rare. CHENANGO: boggy shore of Plymouth pond, *W. 6816*; *E. L. Davis* (1927) (A); rotten logs in mud, McCall's pond, Preston, *W 6815*; Chenango L., *E. L. Davis* (1928) (A). Otherwise unknown in our region except about Oneida L. (59), although common northward in the State (62).

Helianthemum Bicknellii Fern. Locally frequent. CHEMUNG: rocky slopes, Cobble hill, *S 1053*; sandy bushlot near crest of Sullivan hill, *S 88* (pubescence of calyx longer and looser than crisp-puberulent); in dry soil, roadside, just e. of Mountain House narrows, *L* (E); abundant on sandy knolls at base of Sullivan hill*; on grassy, shaly slopes, Bowman hill*; sandy slopes near Unilar bog*. 4 stations at the s. end of the Cayuga basin (111); hitherto not reported from the Susquehanna drainage; locally common across the State (62).

H. canadense (L.) Mx. Rare. CHEMUNG: rocky slopes, Cobble hill, *S 1052*. In the Oneida L. region (22; 59); the W. Junius area (111); Apalachin (14) and lower Cayuta Ck (76); later considered frequent along the river in Tioga co. (26), but possibly confused with the last.

Lechea intermedia Leggett. Locally abundant. TIOGA: dry open field, e. shore of Spencer L., *W 18059*; CHEMUNG: abundant over small area on sandy river knolls, base of Sullivan hill, *S 70*; old rocky pasture, w. side of Bowman hill, *S 332*; rocky slopes, Cobble hill, *S 1054*; sandy slopes near Unilar bog*; dryish woods and marginal fields, crest of Mt Zoar, *S 2089*. Previously known only from Salmon Ck, Cayuga co. (111), about Oneida L. (59) and Elmira (14) for our area. Common across the State n. of the Hudson highlands and s. of the Adirondacks (62).

Viola striata Ait. Generally infrequent (14; 62; 111); more rare southward. CAYUGA: Moravia, head of Sylvan L., *F. S. Curtis*; CHEMUNG: along rr. and in moist meadow near-by, Rodbourn*; along Cayuta Ck, n. of pipeline*. Several stations in Tompkins co. (111); common near Oxford (14) and along the river in Tioga co. (26); only at Ashland in the Chemung drainage (68).

V. Selkirkii Pursh. Locally common northward; rare southward (62). MADISON: Morrisville, *L. M. Underwood* (S): CAYUGA: swampy edge of pine woods nw. of Fillmore glen, Moravia, *A*; Dry Ck, Moravia, *F. C. Curtice*; CHENANGO: West hill, Norwich, *M. E. Fitch*; CORTLAND: slope ne. of Chicago bog, *M & C 18596*; TOMPKINS: moist, mossy ledges, Carter Ck*; SCHUYLER: Cayuta ravine, *Wr 12547*; wooded s. slope of ravine, 1 mi. n. of Alpine, *C & W. C. Wilson 3409* (B). Abundant in Oneida co. (85); common in Onondaga (43) and Tompkins (111) counties; previously reported only at Port Dickinson (75), Oxford (14) and Vestal (14) for the upper Susquehanna.

V. sagittata Ait. Rare. CHEMUNG: rocky pasture, base of Laurel hill, *S 320*. About Oneida L. (59) and at Apalachin (26), but otherwise apparently absent from between the Hudson valley (62) and Erie co. (113). The plants are of the pubescent phase, recently considered typical (93), here seeming quite as distinct from *V. fimbriatula* Sm. (*V. sagittata* var. *ovata*) as many species in this group are from each other, but much experimentation needs to be done.

Epilobium palustre L. var. **monticola** Hausskn. Extremely rare. TIOGA: sphagnum bog, Oakley Sw., *H. M. Mapes*. Possibly new to the region, the *E. palustre* of earlier reports perhaps being other of the smaller species. *E. palustre* var. *monticola* is frequent, northward in the State (62).

Proserpinaca palustris L. var. **crebra** Fern. & Grisc. (*P. palustris* of manuals, as to northeastern race—40). Scarce. ONEIDA: swamp along s. shore of Black Ck, *M 14856*; swamp, Sylvan Beach, *W*; MADISON: marshes e. of N. Manlius, *H 24326*; CAYUGA: swamp, head of Owasco L., *A*; CORTLAND: very wet marshy border of millpond between Homer and Cortland, *W 2930*; CHEMUNG: abundant in mats on wet, sedgy meadow, Gee Sw., *S 461*; SCHUYLER: in mud, e. shore of Cayuta L.* Infrequent across

the State (62) and in the Susquehanna drainage proper (82); in the northern marshes of the Cayuga basin and at Renwick (111); at Gorham (85); but absent from the Chemung.

Aralia hispida Vent. Common northward (62); infrequent or rare southward (14; 62; 111). CHENANGO: near Bliven's pond, McDonough, *Wr, Wr, & G. B. Upton 12622*; scrubby low roadside, Plymouth, *W 6939*; CORTLAND: Labrador hill, Truxton, *W*; TOMPKINS: dry woods, Carter Ck*; CHEMUNG: bush-lot, s. slope of Laurel hill, *S 487*; wet thickets, Rodbourn marsh* and Greatsinger Corners*. 7 stations for the s. end of the Cayuga basin (111); 5 older Susquehanna stations (14; 15); infrequent in Tioga co. (26); "rare in Chemung co., more common in Steuben co." (14).

Chimaphila maculata (L.) Pursh. Local. ONONDAGA: Mud L., Baldwinsville, *W. W. Rowlee*; WAYNE: woods s. of Mud pond, Conquest, *Wr & Wr 13754*; TOMPKINS: state reforestation area 2 (fragment brought in by *C. M. Atwood*, not preserved). Rare (14; 26; 62; 111).

Monotropa Hypopitys L. var. **lanuginosa** (Mx.) Domin (*M. Hypopitys* Auct. amer.; *Hypopitys lanuginosa*, incl. *H. americana*—66). Occasional. CAYUGA: oak woods, Moravia, *F. C. Curtice*; TIOGA: dry woods, state reforestation area 1*; TOMPKINS: hill n. of Slaterville Sw.*; CHEMUNG: beech-chestnut-hemlock woods, n. slope of Laurel hill, *C & K. W. Hunt 2072*; SCHUYLER: rich woods in ravine, w. side of Waneta L., *C 779*; Cayuta ravine, Catherine Twp, *Wr 12664*; STEUBEN: Woodhull, *B. B. Stroud* (Bk); dryish oak woods, Oak Hill, Campbell, *G. D. Cornell* (Cl). Occasional in the Cayuga basin, whence definitely reported only from Tompkins co. (111); not hitherto reported w. of Broome co. for the Susquehanna, although 8 stations cited eastward (14; 85); infrequent throughout the State (62).

Kalmia polifolia Wang. Rare and local. ONONDAGA: bog on e. side, Labrador pond, *C 2129*; CORTLAND: in bog, Labrador Sw., *W*; TIOGA: Oakley Corners Sw., *H. M. Mapes*. Bogs about Oneida L. (43; 54; 57); Duck L. (111); previously reported from 5 other stations in the Susquehanna valley in N. Y. (14; 15; 85); more common northward (62; 81).

Chamaedaphne calyculata (L.) Moench. Frequent to common, but rare in the Chemung valley (14; 26; 62; 111). STEUBEN: Cinnamon L., *L* (E); peat bog about 1½ mi. w. of Atlanta, *C et al. 2682*. Hitherto reported only from Wayland (68) for the Chemung.

Andromeda glaucophylla Link. Rare westward with us. STEUBEN: bog, w. end of Cranberry L., *R. McVaugh & Cu 7437*. Onondaga Co. (22); at Michigan Hollow, in the McLean region, and on the bogs northward for the Cayuga basin (111); not heretofore reported from w. of N. Barton (26) for the Susquehanna, although common eastward (14). In cold bogs southward in the State (62).

Lyonia ligustrina (L.) DC. (*Xolisma ligustrina. Lyonia* Nutt., nom. cons.—104). Local. CHEMUNG: wet ground, hill slopes, West hill, Elmira, *L* (E); small, dense colony in peaty soil, Unilar bog, *S 1611*. Apparently only about Oneida L. (59) and at South hill, Ithaca (111), for the Finger Lakes region; common eastward in the Susquehanna (14; 26); rare westward (14).

Gaultheria hispidula (L.) Muhl. (*Chiogenes hispidula*—2). Infrequent. CHENANGO: Afton Sw., *M et al. 15855*; swamp n. of McCall's pond, *M et al. 15854*; CAYUGA: near Locke pond, *anon.;* CORTLAND: bog s. of Labrador pond, *M 14034*; BROOME: boggy area, Chenango State park, Chenango Forks, *C & N. M. Bump 19205*; sphagnum bog, Killawog, *Wr, Wr, & G. B. Upton*; WAYNE: hummock in arbor-vitae swamp e. of Clyde, *W 8601*; TOMPKINS: in sphagnum, Ringwood, *A. Gershoy & A. R. Bechtel 8599*; Caroline Station in a bog, *F. C. Curtice*. Rare to scarce except northeastward in our area (14; 62; 111); not reported from the Chemung.

Vaccinium macrocarpon Ait. (*Oxycoccus macrocarpus*). Infrequent or local. CHENANGO: boggy shore, Plymouth pond, *W 6997*; boggy shore, McCall's pond, Preston, *W 6995*; TIOGA: Summit marsh, Spencer, *A. R. Bechtel & W 8616*; CHEMUNG: boggy ground on old rr. switch, n. side Bowman hill, *S 397* (undoubtedly introduced); STEUBEN: bog at w. end of Cranberry L., *R. McVaugh & Cu 7434*; Cinnamon L., *G. D. Cornell* (Cl). Infrequent in the region eastward (14; 62; 111); more common northeastward (22; 43; 62; 85); rare westward in the State (62); new to the Chemung valley.

Phlox divaricata L. Frequent in the State s. of the Adirondacks and outside of the Delaware and Susquehanna drainages (62). CHEMUNG: rich woods, Lowman Sw., *L* (E); bank of Chemung opposite Bohemia, *L* (E); open woods and swales, Sullivanville*; SCHUYLER: stony thicket, Jackson Hollow*. Occasional in the Susquehanna valley, except in Tioga co., where definitely cited only from Apalachin Ck (14; 26).

Trichostema dichotomum L. Rare. CHEMUNG: abundant on sandy knolls near Unilar bog, *S & S. C. Smith*. About Oneida L. (59); reported from Thornden (43); 3 localities along Fall Ck near Cornell U. (111); on a hill sw. of W. Danby (111); flats opposite Apalachin (14); locally abundant eastward in the State outside of the Adirondacks (81).

Agastache scrophulariaefolia (Willd.) Ktze. Rare and local. CHEMUNG: fence row thicket along rr., n. side Bowman hill, *S 419*; fence row thicket, s. side of Mt Zoar*. Onondaga co. (43); along Paine Ck (111); 3 stations about Ithaca (111); Port Dickinson (14); Barton (14); 2 other Chemung co. stations (14); Yates co. (85). Infrequent or rare throughout most of the State (62).

Monarda clinopodia L. Also rare. CHEMUNG: moist woods near Big I., *R. McVaugh & Cu 7507*; bend of Chemung R. opposite

Bohemia, *L* (E); STEUBEN: near base of hill, n. of Oak Hill. n. side Canisteo R., Canisteo Twp, *C & H. Trapido 2707*; vicinity of Campbell, *G. D. Cornell* (Cl). At 3 Tompkins co. stations (111); "plentiful along the riverbanks and at Mutton Hill pond," in Tioga co. (15); at Mountain House narrows (4); Painted Post (4); Rathbone (87). Infrequent from Broome, Chenango and Oneida counties, westward (62).

Veronica humifusa Dickson. Very rare. SCHUYLER: 2 plants at edge of small spring, rich woodland, Arnot forest, *S 693*. Otherwise listed from Taberg (62) and Slaterville Springs (94) for our region; also from Essex, Oswego and Sullivan counties (94) for our State.

Aureolaria flava (L.) Farw. (*A glauca*—94). Locally frequent (14; 26; 62; 111). CHEMUNG: Comfort hill, a single plant*. New to the Chemung valley.

Gerardia tenuifolia Vahl (*Agalinis tenuifolia*—94). Locally frequent across the State (62). CHEMUNG: dry soil, Sullivan hill, *L* (E); rocky slope, sw. corner of Bowman hill, *S 410*; dryish slope n. of Quarry farm*; dryish woods, s. side of Mt Zoar*; ONTARIO: Geneva, *W. M. Smith* (S). Rare in the Cayuga basin (111) and in the Chemung valley (14), whence up to now, definitely cited only from Corning (92).

Orobanche uniflora L. (*Aphyllon uniflorum*). Infrequent, but widely distributed (62). MADISON: Morrisville, *L. M. Underwood* (S); ONONDAGA: moist woods, Jamesville, *H* (S); Oakwood, Syracuse, *H* (S); CHENANGO: Norwich, *H. L. Stewart*; damp rich woods along Bowman Ck., E. McDonough, *C. & J. L. Edwards 2583*; TOMPKINS: s. side of Taughannock ravine, *E. M. Cipperly & W*; open grassy space near edge of wood, Bailiwick, Ithaca, *B* (B); CHEMUNG: open woods, Comfort hill*; ONTARIO: Geneva, *J. D. Ford* (S).

Galium labradoricum Wiegand. Common northeastward (62). CHEMUNG: scattered among bushes, on sphagnum, Red Jacket Sw., *S, C, & R. Ross 2055*. Otherwise reported for our area from Pecksport and Peterboro (57), the bogs at the n. end of Cayuga L. (111), and the McLean region (111).

G. trifidum L. Scarce. CHENANGO: on logs, boggy shore of McCall's pond, Preston, *W 7167*; CORTLAND: boggy shore of Little York L., e. of Pavilion, Preble Twp, *E. L. Palmer 1135*; Labrador Sw., *W. W. Rowlee*; TOMPKINS: Myers Pt, *anon.*; STEUBEN: bog along s. end of Round L., near Sonora, *M 15938*. Common northward, in central N. Y., and on the Ontario lowlands (62); about the Junius marlponds and at 4 Tompkins co. stations (111); the typical race has previously been definitely reported for the Susquehanna region only from Spencer L. and vicinity (111). (Ssp. *tinctorium* (L.) Hara (*G. Claytoni*—46) is common in the latter drainage.)

Lonicera oblongifolia (Goldie) Hook. Scarce southward in the State. CAYUGA: Halls Sw., Dresserville, *A*; CORTLAND: Green Lake, Preble, *W & R. N. Jones 8837*; CHEMUNG: Red Jacket Sw., *S et al. 1415*; STEUBEN: Wayland Sw., *W 15954*. Frequent northward (62); scarce in the Cayuga basin (111), where mostly at the northern end; also at Summit L., Otsego co., the headwaters of the Unadilla, and Otter Ck, Cortland (20; 85), in the upper Susquehanna.

L. hirsuta Eaton. Local. CORTLAND: thickets bordering Papish pond, Cincinnatus, *S & D 1209*; Cortland, *S. N. Cowles* (S); TOMPKINS: Malloryville, ex. herb. *I. A. Arnold*; CHEMUNG: large mounding tangle in fence row thicket n. of Red Jacket Sw., *S 1463*. Frequent, at least northward in the State (62); Onondaga co. (43); Freeville (111); Otsego co. (85); N. Pinnacle, Caroline (111); Summit Marsh, Tioga co. (111); Potter, Yates co. (85).

Viburnum Opulus L. var. **americanum** Ait. (native *V. Opulus* of manuals). Scarce throughout the region, as in the Cayuga basin (111). CAYUGA: Hall's Sw., Dresserville, *A*; near L. Como, *A*; Woods pond, Scipio, *A*; CORTLAND: Preble Sw., along rr., *W 1152*; CHEMUNG: a few shrubs along Catherine Ck, Red Jacket Sw., *S et al. 1639*; STEUBEN: swamp about 1 mi. w. of Atlanta, *C et al. 2689*. Common northward, but less frequent or rare westward in the State (62). In Onondaga co. (22); scarce in the Cayuga basin (111); new to the Chemung; otherwise sparing throughout the Susquehanna (14).

Valeriana uliginosa (T. & G.) Walp. Very rare. CHEMUNG: 1 flowering plant and several "rosettes" in a clump among bushes, Red Jacket Sw., *S, C, & R. Ross 2050*. Otherwise in N. Y. State from Bergen Sw. e. to Otsego, Herkimer, and Lewis counties (62); also at Pine Plains, Dutchess co. (111). For our region, heretofore definitely reported only from Tamarack Sw., Syracuse (43), and the Ontario plain edge of the Cayuga basin (111).

Liatris scariosa (L.) Willd. (*Laciniaria scariosa. Liatris* Schreb., nom. cons.—*7*). Very rare. TOMPKINS: weedpatch, n. end of suspension bridge, *A. L. Grant 16311* (doubtless introduced); CHEMUNG: Cobble hill, *L* (E); several plants, edge of woods, top of steep shaly hill s. of Latta brook, *S 2016*. Hitherto reported for our area only from the Onondaga Indian reservation (43); elsewhere in the State only southeastward (62).

Solidago ulmifolia Muhl. Rather frequent, at least in CHEMUNG: shaly cliffs n. of Horseheads, *S 1025*; same habitat, Wellsburg narrows*, Mt Zoar*, and Fitch's bridge*; SCHUYLER: dry, oak-covered hillside near rr. e. of Montour Falls, *W 8898*. 5 eastern ravine or lake-shore stations in the Cayuga basin (111); reported by Clute only from 2 other Chemung co. stations (14), although later considered infrequent in Tioga co. (26); otherwise unknown

for our region. Infrequent across the State (62). At the Horseheads cliffs, occurs a form with inflorescence of a single main branch with several branchlets, none over 15 mm. long, *S 1026*. Wiegand pointed out its obvious connection.

Aster lucidulus (Gray) Wiegand (*A. puniceus* var. *lucidulus*). Rare. ONONDAGA: Danforth, *M. L. Overacker* (S); CHEMUNG: dryish edge of Red Jacket Sw.* Reported from the Lowery ponds and Ludlowville (111); unknown in the N. Y. Susquehanna drainage.

A. paniculatus Lam. (*A. paniculatus* in part of manuals—110). Rare. CHEMUNG: wet meadow, Red Jacket Sw., *S, Al, et al. 1227*; slough near Fitch's bridge*. A collection from roadside, s. side lower Six Mile ravine, *E 5205*, and one from a marly bog s. of Merrillsville, *H 27119*, are rather intermediate between var. *typicus* and the common var. *simplex* (Willd.) Burg., the main cauline leaves long and narrow, but somewhat broader than typical and serrate. Wiegand considers var. *typicus* "frequent in northern New York, but rare elsewhere in the State," in contrast to var. *simplex*: "the common and almost exclusive form in Central New York." It has been observed about Watertown that the plant of waste places is var. *simplex*; that of swamps and other less disturbed areas is var. *typicus*.

A. pilosus Willd. (*A. ericoides* var. *pilosus*—6). Unusual. MADISON: fields, South bay, *H 18963* (S); dry field s. of Merrillsville, *H27118* (S); dry soil, Lewis Point, *H 26121* (S); CAYUGA: Glenwood beach, *G. Arnold;* TOMPKINS: Hillendale golf course, 5 mi. w. of Cayuga L., near Jacksonville, *F. Boyle 20248*; CHEMUNG: sandy knoll, base of Sullivan hill, *S 81*; rocky old field, Mt Zoar, *S 1056*; upland field, Bowman hill*. Considered frequent in the State within the range of the collective species (*A. ericoides*) "especially southward" (62); not reported by the local floras. The writer considers this the native variant here; the var. *demotus Blake* (*A. ericoides* Auct., non L.) introduced.

Antennaria canadensis Greene. Probably common throughout. CHEMUNG: open scrub field, w. slope of Reservoir hill, Horseheads, *S 1405*; dryish knolls, w. side of Red Jacket Sw., *S et al. 1646*; swaly field, Park Station*. Generally common in the Cayuga basin (111); "less common southward....and westward on the highlands of central and western New York"; rare in the Southern Tier (62).

Polymnia canadensis L. (*Osteospermum canadense*. Choice of *P. canadensis* as type of the genus (7), effects conservation of *Polymnia* L. for the group of plants here concerned). Rare. CAYUGA: in a deep hollow near Sheldrake Pt, *N. W. Folwell*; shore of Cayuga L., Sheldrake, *A*; near Aurora, moist shaded ravines, *F. C. Curtice*; CHEMUNG: near Mountain House narrows, in warm, rocky soil, *L* (E); talus-slope along river, Mt Zoar*. Common in Madison and Onondaga counties (62); reported at the

Owasco Outlet (85); scattered about Cayuga L. (111); also cited from Otsego co. (62), South Mt (14), Apalachin (14), Chemung narrows (14), Athens, Pa. (15), Rathbone (88), and the North Pinnacle, Caroline (111) for the Susquehanna valley; at Gorham (85).

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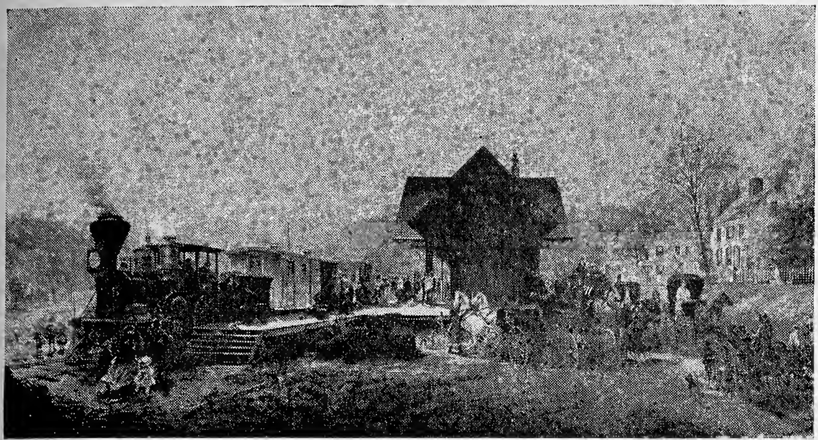

The Life and Work

of

EDWARD LAMSON HENRY N.A.

1841-1919

by

Elizabeth McCausland M.A.

NEW YORK STATE MUSEUM

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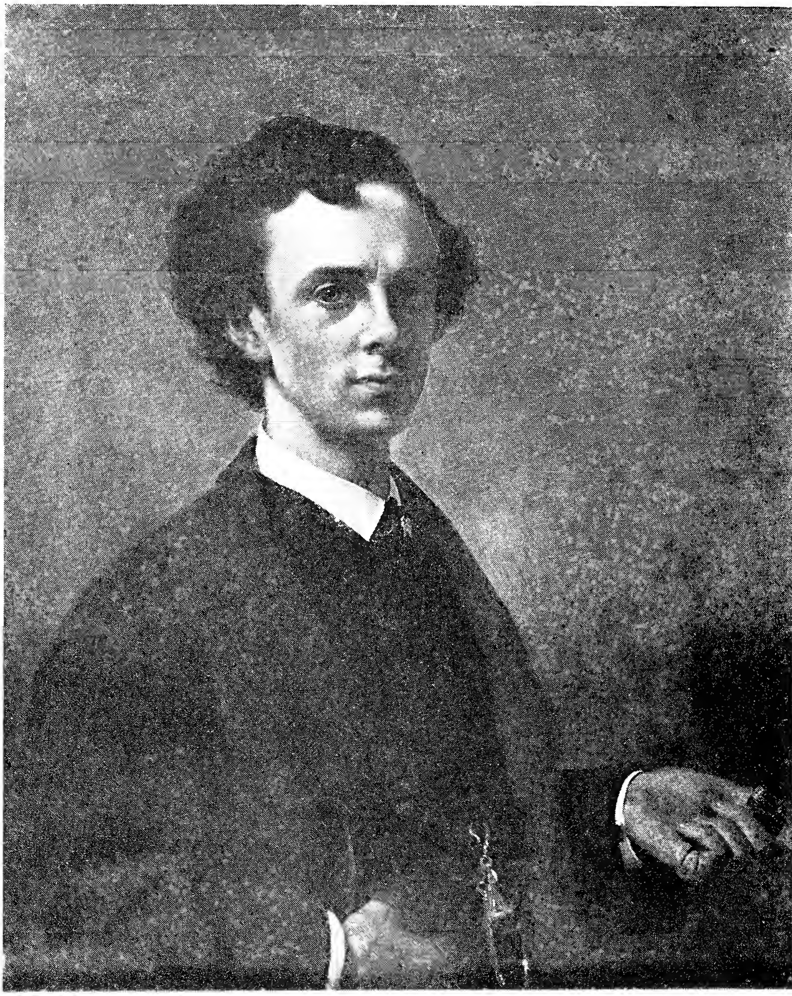

Figure 1 Portrait of E. L. Henry, N.A., by J. G. Brown, N.A., 1868: CAT. 1218. Presented to the Academy when Henry became an associate. Collection, National Academy of Design.

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CHARLES C. ADAMS, *Director*

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Contents

List of Illustrations

All illustrations are from the Henry Collection, New York State Museum, unless otherwise credited. The quotations are verbatim transcripts of Henry's own inscriptions on photographs and other items.

Introductory Note

In 1836 the State of New York inaugurated a policy of cultivating a knowledge of the natural and human resources of the State. This agency was named the Geological and Natural History Survey, and later in 1853 under the Board of Regents, the State began to form an Historical and Antiquarian Collection. These organizations were fused in 1870 to form the New York State Museum, and in 1892, 50 years ago, the duties were expanded with specific instructions that: "All scientific specimens and collections, *works of art, objects of historic interest* and similar property appropriate to a general museum, if owned by the State and not placed in other custody by a specific law, shall constitute the State Museum" (italics mine).

During the State Capitol fire in 1911, a large amount of the ethnological and historical material collected by the State Cabinet was destroyed. The State Museum was at the time of the fire in the old Geological Hall on State street and thus escaped damage. It was not moved to the Education Building until 1912.

There has since been an increasing emphasis given to the accumulation of materials illustrating the history and arts of the State, including the culture of the New York Indians, and progressively more and more attention has been given to the industries as well as to the cultural development of the State. When the threatened loss of the cultural objective materials of the Shakers became imminent, the State Museum devoted considerable attention to salvaging as much as possible of their cultural and industrial history. The results of this effort have been elaborated elsewhere (Adams '40, 103d Annual Report. State Mus. Bul. 323, p. 77–141; and Andrews, State Mus. Hdbk. 15, 1933). In recent years there has been a rather widespread awakening of interest in the esthetic value of Shaker industries and their cultural significance.

In the spring of 1940, two devoted friends of the State Museum, Wilfred Thomas and Frank M. Thomas, found an important collection of art material which had been accumulated by the artist Edward Lamson Henry (1841–1919) National Academician, of New York City and Ellenville, which was in the possession of his wife's relatives, Mr and Mrs Lawrence Stetson, Mr and Mrs E. C. Wells and Margaret L. Wells of Johnstown. Through the cooperation of this group the Henry materials,

including sketchbooks, letters, sketches, photographs, paintings and other materials were presented, at the suggestion of Wilfred Thomas, to the State Museum for the History and Art Collection, and to form the *Stetson-Wells, E. L. Henry Collection,* and as a memorial to the artist. This series included a manuscript on the life and work of the artist by his wife, Frances Livingston Wells Henry, which was presented by Mrs Lawrence Stetson. The Messrs Thomas and Thomas also made several valuable donations to this Henry Collection, as have also a few other friends of the memorial. The State Library contains a number of volumes from the Henry library.

Here was considerable material for a study of Henry and a sketch of his life that seemed worthy of study and publication. He was a leading artist of the rural scene during the "Horse and Buggy" period in New York State between 1880 and 1919. He lived in New York City and spent his summers south of the Catskills, at Cragsmoor, near Ellenville.

To make an original study of these extensive materials, and to make a careful evaluation of his work I could learn of no better qualified person for the study than Elizabeth McCausland, art critic and author of New York City, whose judgment and appreciation of the work of American artists qualified her for organizing the mass of material and for making an estimate of these and the allied materials which she and others obtained from friends and acquaintances of the Henrys.

I wish also to take this occasion in order to emphasize what I have previously advocated for a number of years, that the State Museum should be made, as has been provided by law for 50 years, the State's central agency for developing a representative collection of the fine arts, which will clearly portray the contributions which New York State artists, both living and dead, have made to the graphic arts, painting and sculpture. We have long persisted in a period of excessive concentration of such cultural materials in the metropolitan centers, and now we need to inaugurate a certain amount of diffusion or decentralization so that a larger public will have the benefit of these collections. Certainly the State of New York should lead in this matter, and the state capital, at Albany, is the logical place for the State to develop such a collection, as a part of the state educational system. Too often education is considered exclusively a juvenile subject instead of being a lifelong activity. The thousands of tourists and school children who visit each year the exhibition halls of the State

Museum have no other opportunity to learn what has been accomplished through the fine arts in this State.

To provide adequately for such a collection and exhibition would be one more reason for a new building for the State Museum, which 20 years ago outgrew its present quarters in the Education Building (*Cf.* State Mus. Bul. 293, p. 81–110).

It has been suggested that this expansion of art materials be delayed until the new building is provided, but there is much practical experience which indicates that the valuable collections must be secured *first,* and then the importance of their exhibition, care and storage will be appreciated and be provided for. Furthermore, such a building should be built along the newer lines with adequate storage as well as exhibition space. Appropriate donations are therefore welcomed which will portray the past and contemporary history of the fine arts in this State.

Finally, the State Museum should have on its staff artists who are capable of doing original work, just as it has botanists and geologists conducting original ("creative" is the current art term) studies of the plants and rocks of the State. There is just as much reason for the cultural development of art as for science, but we have been slow to recognize this and have not adapted our social and economic system to this end.

This is also the proper place to emphasize the need of the artists, their families, relatives and friends, realizing that the artists' sketches, studies and models should not be allowed to become scattered and lost because of the relative neglect of emphasis on this phase of art, education and history. These materials should be kept intact and preserved in such public institutions as will protect and use them to advantage. As far as I have been able to learn this has not been a general, definite policy of many leading public museums. Something more than a passive attitude is needed toward such material. There should be a constructive policy. The Henry Collection and study is an important step toward the realization of this general policy and program of the New York State Museum.

CHARLES C. ADAMS
Director, New York State Museum

January 11, 1943

Introduction and Acknowledgments

INTRODUCTION. The Henry study was undertaken because a gift to the New York State Museum of extensive materials on E. L. Henry's life and work provided opportunity to develop a function conferred on the State Museum by legislative act half a century ago but not adequately put into practice. The State Museum has long appreciated the need of integrating the arts into its active program. Without question, the arts no less than the sciences have built the State. Therefore, to preserve and to make of public use the State's complete culture, history and art must be explored, as well as the natural history sciences.

The Henry gift made a particularly appropriate occasion for assuming the new function. E. L. Henry was intimately associated with the life of New York State. For almost 40 years he lived and worked at Cragsmoor in the Shawangunk mountains, south of the Catskills. He incorporated a wealth of local subject matter in his paintings. The people of the "Mountain" (Cragsmoor had no legal place name for many years) and much of the terrain around Ellenville, Napanoch, Stone Ridge, Pine Bush and Bruynswick could be recreated by reference to Henry's work, if no other clue to their existence survived. In an especial sense, Henry was the historian of a sector of New York State. Not to utilize the Henry Collection's source materials would have been a social waste.

In the Henry study, the problem was *what* to study. In a very limited period of time and with limited facilities, how much could be accomplished, and what was of prime importance? The Henry Collection comprises a large amount of physical material, ranging from photographs of Henry's paintings to souvenirs of his personality, such as flute, flask, prayer book, fans and the Livingston family coat-of-arms. What use should be made of this material? And how should the resultant findings be presented? Questions like these had to be decided in an experimental spirit, as the problem posed by the Henry study is exceptional.

Rarely does the "immortal residue" of a man, whether a genius or an obscure individual, survive in such sheer, quantitative bulk. In the New York State Museum's Henry Collection there are a score of large files (4x14x18) packed solid with photographs of Henry's work and of related subjects. There are a half dozen

larger boxes and an equal number of letter files, full of more photographs, clippings, documents, correspondence. There are 28 sketchbooks and two diaries; a manuscript biography left uncompleted by Mrs Henry at her death; quantities of large photographs and prints; relicts of Henry's library; an album (16x14) containing about 150 photographs of paintings, of which 66 are not found elsewhere; over 200 sketches in oil, pencil or pen-and-ink, on canvas, wood, cardboard or paper; and a number of works by Henry or by persons associated with him, such as the portrait of him by Charles C. Curran N.A., and the landscapes by Worthington Whittredge and Arthur Parton, probably gifts to Henry. In organizing these study materials, I have sorted out into tentative chronological sequence photographs of more than 300 paintings. In addition, the 225 sketches are for the most part preliminary drawings or details. Correspondence, dating from 1860 to 1931, provides collateral data.

Here is a concentration of materials unusual even in the case of artists whose reputations had not waned before death. With multitudinous documents at hand, it was desirable to examine them to learn what we could of Henry's life and work. In six months, the Henry Collection's materials have been studied fairly intensively. At the same time a search has been made of museum collections and of some exhibition catalogs and literature of Henry's period. In addition, numerous contacts have been followed up for further data. Finally, three weeks were spent in the field at Cragsmoor, Ellenville and surrounding countryside to record as much information as possible from surviving friends and acquaintances of the artist.

My field trip was made at the suggestion of Dr Charles C. Adams, who emphasized the importance of recording informal recollections of those who knew Henry and of seeking other local influences and facts. Henry has been dead 23 years. If he were alive, he would be over a hundred years old. Even so, there are living in Cragsmoor and Ellenville many people who knew him well and whose memories are valuable. My Field Journal in three manuscript volumes (McCausland '41) is a further source of information about Henry. The comparison photographs I made on this field trip, some of which are reproduced in the report, have the value of providing a measuring stick by which we can gage how exactly documentary was Henry's work. In fact, the field trip was an indispensable tool for the study, because it gave me firsthand knowledge of the region where Henry

worked and so has enabled me to make better informed judgments about his paintings. Exploration of the terrain where an artist worked is plainly essential for a thorough understanding of both his subject matter and his spirit; and the technic of field work, imported from the sciences, should be applied to the arts more.

The Henry study presented, as said before, somewhat unusual problems. The State Museum possesses abundant source materials: data are at hand. But connections had to be established. Even if not one fact had been learned outside the Henry Collection, we should still have been able to construct a remarkably detailed and faithful report of this artist's life and work. An evidence of the wealth of material available is the fact that the great majority of illustrations in this report are from our own files. The visual image of Henry's art is well preserved.

The short time allotted the Henry study, compelling a choice between objectives, resulted in one phase of research necessarily being elided, namely, the investigations needed to establish the present location of paintings. The catalog lists 345 items whose present location is known. Of these 118 are oils, water colors and important drawings in the possession of museums, private collectors and dealers. The remainder, 227 in all, are in the Henry Collection of the New York State Museum and comprise chiefly sketches and drawings, although the State Museum owns four canvases by Henry. It is hoped that the exhaustive listing and illustration of unlocated or "lost" works will bring forward information to fill in the lacunae indicated in this preliminary cataloging of Henry's work.

Data were included in the Henry catalog on the principle of exhausting all known facts, which makes not for compactness but for completeness. Under the circumstances, it seemed wise to provide the report's readers with clues which may help unravel remaining snarls. A simple chronological order was chosen since time did not permit elaborate classification and cross references. If a definitive study of Henry should be desired, revision can be made at that time.

Important though the preservation of source materials and the recording of the State's culture are, the Henry study has a value beyond its immediate usefulness. It is intended to encourage the general public to deposit in public institutions those materials which constitute the living archives of our country's achievement. The letters, photographs, diaries, newspaper clippings and other documents of the Henry Collection are a potential source of great

information about Henry, and also about many other matters. About the life of every person of public interest, no matter how minor a figure, there accumulates this increment or matrix, which becomes of value from the historical or documentary point of view. This is an intangible value, rarely capable of being converted into cash. For this reason, these documents are too often destroyed, and their potential of knowledge lost. Obviously, the care and preservation of such material is a public duty; private individuals can not be expected to assume the responsibilities of custodians of culture. More and more, public institutions need to develop this function throughout the country. For our American past has been a rich one, richer than we have imagined, and to reclaim our heritage is an important task.

Acknowledgments. The Henry study has been most happily and gratifyingly cooperative in character. In stressing this fact, I can not thank too warmly the Director of the New York State Museum, Dr Charles C. Adams. He originated the Henry project and brought to its direction the sound common sense of the scientific method, as well as a robust pioneering courage in undertaking a new enterprise. His creative social vision in understanding the need for broad cultural functions and in putting his understanding into effect has been a great stimulus and encouragement in making the study. My work with Doctor Adams has been an education in how state institutions and officials can develop public ends with imagination and intelligence.

I found widespread interest in and support for the study in many quarters, public and private. During my field trip at Cragsmoor and Ellenville, I met many of Henry's old friends, who assisted not only with information but also with gifts of Henry material such as sketches, photographs, prints and related items. As news of the study spread, more gifts came in from various sources. Frequently they provided needed missing links.

For individual gifts subsequent to the large gift from Mrs Henry's heirs, thanks are due: Julie M. Husson, Mary D. Buxton, Jessica Bruce, Annette Mason Ham, Mrs Anna M. Rhoades, Mrs Thomas Wade, Mrs Charles A. Brown, Charles C. Curran, Mr and Mrs Frederick G. Kraft, and Mr and Mrs Charles Peters, all of Cragsmoor; S. D. Mance, Ellenville; Marie Antoinette DuBois, Kingston; Mrs Grace Livingston Hill Lutz, Swarthmore, Pa.; Bernard H. Cone, New York; Wilfred Thomas and Frank M. Thomas, Albany; Mr and Mrs Lawrence Stetson and Margaret

Livingston Wells, Johnstown; Harry Gottlieb, Charles W. Folks, Mrs C. T. Hall and Sidney E. Dickinson, all of New York City.

The donation by Mrs Estelle Wright Bouton of Cragsmoor of almost 50 negatives made by Legrand W. Botsford, "the hermit of Cragsmoor," was invaluable in providing photographs of otherwise unknown Henry paintings and in giving a well-rounded picture of the countryside where Henry spent half his time for 37 years. Supplementary visual material was the loan from Mrs Anna M. Rhoades, Cragsmoor's summer librarian, of negatives of contemporary (1938–41) Cragsmoor landscape and personalities.

Many private individuals, museums and dealers assisted by supplying photographs for reproduction in this report. Thanks are due them as follows: Martin E. Albert, Mrs Francis P. Garvan jr, and Ernest duPont Meyrowitz, New York; Mrs Harcourt Wesson Bull, Springfield, Mass.; Dr and Mrs H. M. Sassaman, Easton, Pa.; the Metropolitan Museum of Art, the National Academy of Design and the New York Historical Society, New York; the Yale University Gallery of Fine Arts, New Haven; the Village of Ellenville; the First Church of Christ, Scientist, Boston; the estate of the late Frances P. Garvan, New York, and the Babcock Galleries, the Bland Gallery, Albert Duveen, James Graham and Sons, John Levy Galleries, M. Knoedler and Company, the Macbeth Galleries, I. Snyderman, and Guy Mayer Galleries, New York City.

Individuals and institutions were unfailingly cooperative in supplying data. Grateful acknowledgment is hereby made of the assistance of: Lloyd Goodrich, research curator, Whitney Museum of American Art, and director, American Art Research Council, who read the manuscript and made invaluable criticisms in a most friendly spirit; John I. H. Baur, curator of paintings and sculpture, Brooklyn Museum, who made valuable suggestions on procedure at the outset of the study, kindly lent the writer the then unpublished autobiography (Whittredge '42) of Worthington Whittredge, a contemporary and friend of Henry, and who further read the manuscript and made proposals, particularly on esthetic points, which were incorporated in the report; Herman Warner Williams jr, Metropolitan Museum of Art, now on leave for service with the armed forces; Bartlett Cowdrey, registrar, Brooklyn Museum; G. E. Kaltenbach, museum registrar and keeper of archives, Art Institute of Chicago; Mrs Cordelia Sargent Pond, director, George Walter Vincent Smith Art Gallery, Springfield,

Mass.; Leicester B. Holland, chief, division of fine arts, Library of Congress; John D. Hatch jr, director, Albany Institute of History and Art; C. Powell Minnigerode, director, Corcoran Gallery of Art, Washington, D. C.; Earl Rowland, director, Haggin Memorial Art Galleries, Stockton, Calif.; R. P. Tolman, acting director, Smithsonian Institution, Washington, D. C.; the late Charles C. Curran, corresponding secretary, National Academy of Design, New York City; Aline Kistler, then assistant director of exhibitions in charge of public relations, National Academy of Design, New York City, and Frick Art Reference Library, New York City.

The receipt of information is gratefully acknowledged from many private individuals, including: Harcourt Wesson Bull jr, and Mrs William B. Kirkham, Springfield, Mass.; Mrs Warren van Kleeck, Brooklyn; Dr Ewen van Kleeck, Hartford, Conn.; Kathrin Cawein, Pleasantville; Winifield Scott Clime, Old Lyme, Conn.; George J. Corbett and Katherine Greves, for the estate of the late Francis P. Garvan; Victor D. Spark; F. Newlin Price; Joseph Gotlieb of the Milch Galleries; Frank Lord, chairman of the Union League Club's art committee, and Theodore Bolton, librarian, Century Association. Publications which assisted by printing notices are the Art Digest, the Springfield (Mass.) Sunday Union and Republican, the Ellenville Press and the Kingston Freeman.

Finally, warmest thanks are due those who aided me at the outset by cooperating enthusiastically in the investigations of my field trip. A personal word of thanks is especially due Mrs Florence T. Taylor, librarian, Ellenville Public Library, who took a keen interest in the purposes of the study and who supplied invaluable leads to other informants. Of equal good will and cooperativeness was Mrs Anna M. Rhoades, librarian, Cragsmoor Free Library, already mentioned for a gift and the loan of negatives. The list of those who assisted with information is proof of the social nature of all such studies.

Thanks are due, besides those already given, to: Mary D. Buxton, Mrs Estelle Wright Bouton, Mrs Addison Brown, Mrs Charles A. Brown, Jessica Bruce, Mrs R. J. Compton, Charles C. Curran, Mrs R. L. Foster, Annette Mason Ham, Julie M. Husson, John Kindberg, Grace J. Kudlich, Mrs Walter P. Long, Mr and Mrs Charles H. Peters, Mrs C. Stevens Polk, Mrs R. H. Rulison, Winifred Sturdevant, Sidney Terwilliger, Helen M. Turner, Mrs Thomas Wade, of Cragsmoor; R. T. Cookingham, Casper S.

Cosenza, Raymond G. Cox, Bertha Demarest, C. G. A. Fischer, Mrs Richard Hayden, Mr and Mrs Arthur V. Hoornbeek, Mrs Henry Horton, Mrs Lilah Deyo Johnson, Stephen D. Mance, Alice I. Moffit, Mrs Bert Terwilliger, Mrs Nelson Terwilliger, of Ellenville; Bert Goldsmith, Mount Meenagha; Mrs J. G. M. Hilton, Saugerties; Mrs Lawrence Stetson, Margaret Livingston Wells and Mrs Charles B. Knox, of Johnstown; Mary Hartshorn Woodruff, Nyack, and M. J. DuBois, Kingston.

In thanking those who have cooperated in the Henry study, I wish to mention especially an unseen collaborator, the State Museum's staff photographer, N. E. Baldwin, who copied hundreds of objects for use in this report. The illustrations are for the most part from his photographs. His cooperation is the more appreciated as the fact that I worked in New York and he in Albany complicated the work.

Finally, I wish to stress once more the essentially cooperative and social character of the Henry study and to thank again all those who made possible the publication of this report.

December 18, 1942

E. McC.

Chronology

1841 Edward Lamson Henry born January 12th, at Charleston, S. C.
1858 Art student in Philadelphia
1859 Exhibited first painting at the National Academy of Design
1860 To Europe to study art
1862 Returned to United States and set up as professional artist
1864 Saw service as a captain's clerk in the Union Army
Painted his first railroad picture this year, *Station on "Morris & Essex" Railroad*
1865 Painted his first Civil War subject, *Westover*
Began *City Point, Virginia,* finished in 1872
1866 Elected member of Century Association
Visited Newport and painted there
1867 Elected associate, National Academy of Design
Visited Ellenville and stayed at Mrs Terwilliger's
Painted *The 9.45 A.M. Accommodation, Stratford, Connecticut*
1869 Elected National Academician
Painted *Presentation of Colors*
1871 Abroad again
1872 Finished *City Point,* his Civil War masterpiece
1873 Met Frances Livingston Wells at an artists' reception
1874 Became engaged to Miss Wells
1875 Married and went abroad for honeymoon
1879 The Henrys spent a few days at the Bleakley farm on the "Mountain"
1881 Began to paint genre subjects of Cragsmoor country life
1883 Bought land for home at Cragsmoor
1884 Built home from his own plans
1887 Sale by Ortgies & Co., auctioneers, of Henry's antiques
1888 Travels in the south
1890 Painted *A Country School* and *A Virginia Wedding*
During the decade 1890–1900 painted many transportation subjects, especially scenes along the Delaware and Hudson Canal
1892-3 Painted *The First Railway Train on the Mohawk and Hudson Road,* shown in the Transportation Building, Chicago World's Fair

1898 Painted *Sunday Morning (The Old Dutch Church at Bruynswick)*

1905 Painted his first automobile subject, *A Disturber of the Peace*

1914 Painted a commission for the First Church of Christ, Scientist; also *The Four Seasons* and *Contrasts*, a second automobile theme

1917 Painted *The Floating Bridge* and *St Mark's in the Bowery*

1919 Died at Ellenville, May 11th

Biographical Sketch

THIS SKETCH is based almost wholly on source materials in the Henry Collection. Its purpose is to present all available facts about Henry's life; for biographical entries in various reference works are brief and not too accurate. The sketch is therefore thoroughly documented, the source of a statement being indicated in parentheses by the following abbreviations:

BIOG.	Biographical
CL.	Clippings
CORR.	Correspondence
DOC.	Documents
PH.	Photographs

The date follows the designation. References to the Henry catalog and to illustrations in the report are abbreviated to CAT. and FIG.

Education and Early Life

Childhood. E. L. Henry was born in Charleston, S. C., on January 12, 1841, the son of Frederick and Elizabeth (Fairbanks) Henry. At seven he was taken to New York (Anonymous, 1928–36, 8547–48). Although his life is copiously documented, there is little material on his childhood. In the Henry Collection there are two photographs of his birthplace, one of which (FIG. 4) is inscribed *Old House in Society Street, Charleston, where I lived when I was a little One.* Another inscription records the fact that it was built in 1820. In Sketchbook 9 (CAT. 1193) there is a drawing of the house, apparently made in the eighties.

There is no information about his moving north. He was an orphan, living with his cousins, the Stows (McCausland '41, p. 207). Mrs Henry in her Memorial Sketch (p. 313) describes Henry as a talented child, put to drawing to keep him quiet in church. She adds that he had to overcome opposition from his family before he was permitted to study art. A small oil painting in the Henry Collection (No. 1628)—6½ by 9¼ inches, oil on paper, by Walter M. Oddie—adds further data. It is inscribed in Henry's writing as follows:

> *A Sketch by W. M. Oddie, 1854. Presented to me in 1855 while at school and my first visit to a studio and Mr Oddie kindly presented me this sketch. I studied a short time with him in painting, 1855. W. M. Oddie's studio was on Broadway below Canal Street, East side.*

The first direct datum on Henry is the photograph in the Henry Collection of him (FIG. 2) as a youth of 17, studying art in Philadelphia in 1858. He studied there at the Pennsylvania Academy of Fine Arts and also with F. Weber.

Education. From 1858 on, there is a quantity of data about his development as an artist. He studied formally in Philadelphia, as later he would with Suisse, Gleyre and Courbet in Paris. At the same time he sketched industriously from nature, as he did throughout his life. The sketches in the Henry Collection—*Great Bend, Susquehanna,* 1858 (CAT. 1; FIG. 85), *West Point from Prof. Weir's,* 1858 (CAT. 2), *Bethlehem, Pa.,* 1859 (CAT. 3), *On the Lehigh, Penn.,* 1859 (CAT. 4), and *Mauch Chunk, Pa.,* (CAT. 5; FIG. 86)—show how he scoured the countryside for subjects. There are numerous related scenes in his sketchbooks (CAT. 1185–1212). The barnyard series (CAT. 6–9; 11–15; FIGS. 88–93) testifies that Henry thoroughly explored a subject when it interested him.

A barnyard scene, in fact, brought his first public recognition, in a press notice printed in the New York Daily News, Wednesday morning, June 8, 1859 (FIG. 228). At 18, Henry was exhibiting in the National Academy of Design exhibition, in which he continued to show his work for 60 years. The notice reads:

ACADEMY OF FINE ARTS—NO. VII

Northeast Gallery

> *No. 187, Barn-Yard Scene—Ed. L. Henry, Philadelphia. A very natural, conscientious and well painted picture, beautiful in composition, by a young and most talented artist. We do not feel like seeking for its fault, being satisfied that Mr Henry only requires experience, combined with that judgment which we think he possesses, to enable him to repair and improve effectually any deficiencies which may be in this picture. We are much mistaken if there is not a foreshadowing of great excellence in this "Barn-Yard Scene."*

Critical encouragement may have served to persuade young Henry's family of the seriousness of his purpose and to induce them to send him abroad. At any rate, *Off to Europe,* 1860 (CAT. 17; FIG. 229) documents the start of the young art student's European studies and travels, which are well recorded in a number of drawings (CAT. 18–32; FIGS. 233–41). Mrs Henry's Memorial Sketch, quoting from diaries which have been lost, gives his itinerary. He left New York September 22, 1860, for London, remaining there till October 29th, then went to Paris, "where he

began his studies." (p.315). His passport is pasted on manuscript p. 11 of Mrs Henry's life.

Interests which influenced Henry's work in later life had appeared before he went abroad. His enthusiasm for all forms of transportation, from horse, oxcart and bicycle to steamboat, railroad train and early automobile, is shown in drawings like *U. S. Sloop of War Lancaster,* May 23, 1859; several sidewheelers, including *King Philip,* New York, 1859; *Launch, Navy Yard, Brooklyn,* 1860; a horse car, *Astor House. 3rd Ave. Line,* and *Le Chemin de fer du New York,* all in Sketchbook 1 (CAT. 1185). His interest in architecture, testified to by scores of photographs of historic buildings and their interiors in the Henry Collection as well as by the architectural subjects he painted, had an early expression in the drawing, *Old Church, near Limerick, Pa.,* dated April 10, 1859, in Sketchbook 1.

Travels. In Europe, Henry's energies were devoted to conventional art education. He studied with Suisse, Gleyre and Courbet, went to the gymnasium, took French lessons, sketched in the Louvre, and developed the graphic talent already revealed in his early drawings (CAT. 1, 5–8; FIGS. 85–86, 88–90) and sketchbooks. The grand tour was still part of a privileged young man's education, so Henry may be found making the circuit early in 1861, as told by Mrs Henry (p. 315). In Rome he made friends. In Sketchbook 1 (CAT. 1185) there is a pencil drawing of the sculptor, Edward Valentine. From Rome, he went to Florence, as may be seen in *In Bella Firenze,* 1861 (CAT. 20; FIG. 233), and saw the spring races, later the subject of *The Races at Florence,* 1864 (CAT. 53); then through the Italian lakes (FIG. 234) and into Germany (FIGS. 235–38).

We could reconstruct Henry's travels in 1861 from drawings annotated with place and date even if we did not have Mrs Henry's report from her husband's missing diaries. *Una Via in Napoli; The Campagna from Frascati; In Bella Firenze; Au Fond du Lac, Colico, Lac du Como; Luino, Lake Maggiore; Cannstadt in Wurtemberg; In Stuttgart; A Berlin Omnibus; A Prussian Canal Boat* (CAT. 18–28; FIGS. 233–38) chronicle Henry at work. He rounded out his European studies in 1862, as recorded by the drawings *In Amsterdam* and *Rotterdam* (CAT. 30, 31; FIGS. 239, 240). Sketchbook 3 (CAT. 1187) fills in gaps—Paris to London, to Chester, to Dublin, to Cork, to Queenstown and back to the United States, attested by *Icebergs Off Banks of Newfoundland* (CAT. 32; FIG. 241).

Henry's method of work is documented early in his working life. A drawing from his ticket for diligence fare from Florence to Genoa (FIG. 230), pasted on the back of manuscript p. 11 of Mrs Henry's sketch, is the first step toward the painting *An Italian Vettura,* 1863 (CAT. 34; FIG. 232). Intermediate is a drawing *Traveling Coach, Italy,* 1862, in Sketchbook 2 (CAT. 1186), reproduced in this report (FIG. 231) to indicate how Henry developed a picture.

Highlights of Henry's social life in Paris were invitations to parties at the United States' minister's. He was beginning to blossom out as the young dandy whom we see in several photographs (FIGS. 3, 5, 6, 12, 33, 35). He was not idle, however. *Italian Scene,* 1861 (CAT. 29) was entered in the National Academy of Design catalog of that year with the note *Now in Rome, Italy.*

Back Home. Home again, Henry carried on two parallel lines of work, painting from European material and at first hand from contemporary American life. The small oil, *The Arno, Florence,* 1863 (CAT. 33), his "diploma picture" on election to the Academy, is related to the drawing of 1861, *In Bella Firenze* (CAT. 20; FIG. 233). *An Italian Vettura* has already been referred to. In 1863 and 1864, Henry painted a number of canvases, none of which has been located, based on notes from European travel, including *Via Pallomette, Via San Lucia, St Maria del Sasso, Canal in Venice, The Italian Man-of-War, Near Palestrina, Street Scene in Naples, Souvenir de Lac Maggiore* and *The Races at Florence* (CAT. 35–37, 39–43, 53).

At the same time, he worked on subject matter of American life, Americana of a character which anticipated his genre painting of the 80's and 90's but which had its own distinct quality. Drawings in Sketchbook 3 (CAT. 1187) of a cow on a treadmill and of a dog on a "dog churn" (FIG. 59), the latter inscribed *Sparta N. J., 1862,* indicate Henry's interest in the world around him. The "dog churn" detail was incorporated in a later painting *Capital and Labor,* 1881 (CAT. 150; FIG. 56). A drawing in the same sketchbook shows Henry at work near Philadelphia in 1863. By 1864, he had painted his first railroad picture *Station on "Morris and Essex" Railroad* (CAT. 44; FIG. 108), which has not been located. Another "lost" picture which arouses curiosity is *Russian Fleet at Anchor in the North River,* 1863 (CAT. 38). To judge from extant data it was painted on a topical theme and so represents about the only known instance of Henry showing concern with current foreign affairs in his work.

Civil War. In the fall of 1864, Henry saw service in the Union Army as a captain's clerk (p. 319). Small, homemade Sketchbook 4 (CAT. 1188), called *War Sketches Oct. & Nov. 1864,* is filled with quick sketches of Negro soldiers; a battleship's foredeck; *The Sinking of the Florida, Newport News; Guard Ship Old Confederate 'Iron Clad' Captured at Savannah, Ga.; Gen. Ingals Hd'Qtrs City Point, Nov. 1864, Appomatox River; Washington from the Potomac; Westover; U S Army Wagon; City Point; Fairfax Church; James River 1864, Harrison's Landing.* In its 24 4x6-inch pages, Henry set down his first rapid notes from what he always called "nature."

Five drawings in the Henry Collection (CAT. 45-48, 51; FIGS. 105, 96–98, 102) and the wash drawing *City Point, Va.,* November, 1864 (CAT. 49; FIG. 106) represent the second stage of subjects later worked up into finished paintings. *City Point, Virginia, Headquarters of General Grant,* 1865–72 (CAT. 96; FIG. 107), perhaps Henry's masterpiece, evolved from two of these sketches (FIGS. 105–106). Other sketches were developed into *On The James River, Va.,* 1864 (CAT. 52), *Westover,* 1865 (CAT. 57; FIG. 103), *Gen. Fitzjohn Porter's Headquarters, James River,* 1868 (CAT. 74), *After the Battle,* 1868 (CAT. 75), and *The Old Westover Mansion,* 1869 (CAT. 84). Civil War themes for which documents have not been found are *A New York Regiment Leaving for the Front,* 1864–67 (CAT. 66; FIG. 101) and *Departure for the Seat of War,* 1869 (CAT. 85), and *The Warning,* 1867 (CAT. 67, 67-*a;* FIG. 104). An important painting on a Civil War theme, not a front line subject, is *Presentation of Colors to the First Colored Regiment,* 1869 (CAT. 82; FIG. 100). The original sketch and commission for this painting are in the Henry Collection—a scrap of paper three and three-eighths by four and three-fourths inches (CAT. 82-*a;* FIG. 99). The picture was to be painted for $500, according to a note on the back of the sketch.

The Civil War did not effect a radical break in Henry's life, as it did in the lives of many American intellectuals. In 1864 and 1865, he painted more Italian subjects, for which presumably there was a good market. Among these were *The Races at Florence* (CAT. 53) and *St Erasme, Gaeta, Italy* (CAT. 56). At the same time, he continued to document American life with paintings such as *The John Hancock House* (CAT. 54; FIG. 43) and the lost *Residence at Poughkeepsie* (CAT. 55), which to judge from the

photograph on page 39 of the Henry Album was a fine piece of Americana.

Success. Henry settled into a pleasant and prosperous way of life. He did not seem to suffer from frustration. Photographs in the years immediately following the Civil War show him as a young man apparently in affluent circumstances, popular, personable, invited to fashionable Newport homes, feted, successful in the exhibition and sale of his work. The photograph made in Philadelphia in 1865 (FIG. 6) shows the personality evident in later portraits (FIGS. 20, 24 and CAT. 1220; FIG. 32). His smallness of stature, frequently mentioned by those who knew him, doubtless accentuated a kind of cockiness visible in the photographs.

The photograph (FIG. 33) by Sarony (Taft '39, p. 342 *seq.*) in particular expresses this quality. Perhaps it was but natural in a young man, highly successful at the outset of his career. Already Henry included among his patrons James Thomson, B. H. Moore, J. P. G. Foster, Robert Sanford, William E. Dodge, John Taylor Johnson, C. J. Peterson, T. A. Vyse, A. D. Jessup, Henry Dallett, Robert Gordon of London, Dr. J. D. Haren White, J. W. Pinchot, Robert Hoe, the Union League Club, S. P. Avery, Charles E. Gregory, a Miss Ward, the daughter of A. H. Ward (CAT. 89), James W. Drexel, G. F. Tyler, Albert Bierstadt, John Bullard. A decade later William Astor and E. T. Stotesbury are listed among his purchasers.

There was a ready sale for Henry's paintings, to judge from the fact that many were sold even before they were shown in the annual Academy exhibitions. In later life, Henry had the reputation of always selling on varnishing day. The character of his patronage may be gathered from photographs of the Jessup House at Newport (FIG. 35) and of Mrs Jessup's driving rig (FIG. 36). *Porch Scene, Newport, R. I.,* 1866 (CAT. 61; FIG. 37) and *Four-in-Hand, Central Park, New York,* 1867 (CAT. 64; FIG. 38), both apparently commissions from T. A. Vyse, suggest the scale of income and manner of life of Henry's patrons. That he was on friendly terms with them may be learned from the photograph of the party on the Jessup front porch (FIG. 35) and from the note inscribed by Henry on a photograph of the painting *From a Window, Newport,* 1866 (CAT. 62; FIG. 34), which reads *From a Sketch After Nature, July 1866, Jessup's, Newport, R. I.*

Financial success was reinforced by the prestige of election to the National Academy of Design as an associate in 1867, this at the age of 26. The portrait by J. G. Brown (FIG. 1), presented

by Henry to the Academy as is customary on election, and the pencil drawing by Brown (FIG. 3), show the young A.N.A. as something of a dandy, an impression given also by the stereopticon view of him at Lake George in 1874 (FIG. 12).

Patronage. Life was not all sales and success, however, even for a young, talented, dashing painter. A letter from Mrs Blomfield H. Moore of Philadelphia suggests that in the eyes of some wealthy patrons the artist was not rated highly. The letter writer is recorded in the Henry Collection by a faded photograph, touched up in pencil. The letter (CORR. '68), well worth considering as a sample of the code of manners between patron and artist, follows:

> *My dear Mr Henry:*
>
> *Who is responsible for the blunder concerning Mr Hubbard's picture? I am extremely mortified by it. You will remember that I ordered through you duplicates of the two pictures painted by Mr Brown and Mr Hubbard for Miss Cushman's Album.* The size that they could paint for $100. *Mr Brown's arrived, and was entirely satisfactory, bill included. But here, upon my return to the city, I find Mr Hubbard's with bill of $150!*
>
> *Judging from the price of similar paintings, I expected one at least twice the size for $100. Of course, had he not exceeded my order, I should have been obliged to retain this one, small as it is; but as he has charged me $50 more, Mr Moore says that I must return it to him, which I shall do by today's express.*
>
> *I shall order no more pictures, but wait until I can purchase them already painted, as there seems to be so much uncertainty about the way in which they are filled etc. You remember that Mr Beard would not take an order from me, excepting with the understanding that he could do as he chose about filling it.*
>
> *After all, it is much the better way to wait until you see a picture that takes your fancy (as we did with yours) and then purchase it, when there is sure to be no misunderstanding. I expect to be in New York soon, and then I shall visit the studios.*

Studio Life. Henry worked during this period in the Tenth Street Studio Building, 51 W. Tenth street, which housed almost every successful artist of the time. Apparently he lived with his cousins, the Stows, at No. 218 E. Tenth street (FIG. 19). A stereopticon view, taken in 1866 in Worthington Whittredge's studio (FIG. 7), records the solid middle class character of the artistic life, certainly by no stretch of the imagination Bohemian. The group shown in the photograph were: Thomas Le Clare, J. F. Weir, Whittredge (Whittredge '42), John W. Casilear, S. R. Gifford, J. G. Brown (CAT. 1218; FIG. 1, FIG. 3), Jervis Mc-Entee, William Hart, William Beard, Regis Gignoux, R. W. Hubbard, S. J. Guy, and Henry himself.

Henry had a studio at this address till 1885, when he moved to even more luxurious quarters at No. 3 Washington Square North (FIG. 20). The view along Tenth street is the subject of his *Tenth Street Studio Building,* 1877 (CAT. 132; FIG. 258), which Henry gave to the National Academy in 1911, with a note of the circumstances connected with the painting. It was at an artists' reception here that he met Frances Livingston Wells (FIGS. 8–11), an event which Mrs Henry describes in her Memorial Sketch (p. 320).

Before Henry settled down to the placid tempo of his married life, however, he made another trip abroad, carrying with him letters of introduction (CORR. '71) from Benjamin Franklin Reinhart to Col. D. D. Muter, editor, Anglo-American Times, and H. Graves, "art publisher, Pall Mall." Sketchbook 8 (CAT. 1192) records his travels in Ireland, Belgium and Germany. The only paintings we know of from this trip are *The Passion Play, Oberammergau,* 1872 (CAT. 99) and *Alt Kirche, Oberammergau,* 1872 (CAT. 100; FIG. 115).

Marriage and Maturity

Courtship. Henry's courtship and marriage are relatively undocumented. The Henrys' love letters were destroyed. What remains in the Henry Collection gives a rather dry, sparse picture of his romance. Nevertheless, marriage was unquestionably a turning point in Henry's life. In the first place, as a result he put down roots at Cragsmoor, which thereafter became his artistic base of operations. His genre paintings of New York state rural life and characters are the products of this new way of life.

Furthermore, it is not inconceivable that marriage fostered his drive toward success. Interesting aspects of his earlier painting are lost in the work of his middle years, when he expresses satisfactorily the standards of middle class patrons. Yet judged by all records and accounts, Henry's marriage was eminently happy. Mrs Henry's Memorial Sketch, undertaken after Henry's death, was surely no light labor of love. She herself (FIG. 31) was not young, 74, and unfitted by experience for the hard task of writing. Her manuscript (pp. 311–46) is a tribute to their relation.

The Memorial Sketch relates that Mrs Henry, *nee* Frances Livingston Wells of Johnstown, met Henry at an artists' reception at the Tenth Street Studio Building (p. 320). Possibly their meeting

may have taken place at the event documented by a note (CORR. January 29, 1873) pasted in the Henry Scrapbook, which reads:

> *Mr McEntee will be happy to see you, with the other artists of the Studio Building, at his room, tomorrow (Thursday) from 11 to 12 a.m. to show you for your free and frank criticism his last picture (not entirely completed) "Sea from Shore."*

At any rate, it was one of these functions, of which another document in the Henry Collection (DOC. '67) is a printed invitation to the *Private View of William Page's Paintings.*

On May 15th of this year, Henry wrote Miss Wells (CORR. May 15, 1873) as follows:

> *Would you like to go on Tuesday afternoon to the private view etc.—which I enclose. If so, I will call or will be pleased to escort you there. The card of admission I retain as it is too large to place in the envelope. I have rec'd them before, but never availed myself of them. Also made a member but resigned, and I should like to go to this last one. And if you care to go, I will be delighted to have your company, as the card says 'yourself & Ladies.' I may ask Emma & Dot, so don't ask or say anything about it to Miss McCreedy till I know whether they can go.*
>
> *I may go out of town tomorrow and return Saturday p.m. If so I will call and see you Sunday.*
>
> *On the other page is your Enoch Arden, a rough sketch in pen & ink which you suggested.*
>
> *Yours sincerely*
> *E L H*

The sketch on the third page of Henry's letter shows Enoch Arden looking through a window into a brightly lighted room. It is signed, lower left, *F M Wells, del. 1873.*

This brings up an interesting though minor point. Throughout their married life, the Henrys used the twin sets of initials E L H and F L H. An unidentified newspaper clipping of their wedding names the bride Frances Livingston Wells. Yet there are a number of initialed signatures with the middle initial M, probably for the family name Murray, that of her aunt. In Sketchbook 9 (CAT. 1193) there is a sketch inscribed *Sunday Afternoon Aug 3d. 1873. F M W del.* In Sketchbook 11 (CAT. 1195)—inscribed on the cover *Fait pour cher petite Frank Pour mon cher Edward. Aug. 10/74*—there is a drawing of Henry sitting on a campstool before an easel, painting a thumbbox panel, which is inscribed *E. L. Henry. Sketch by F M W.* Did Mrs Henry drop one family name as a middle name and adopt another so that her initials might be similar to her husband's?

There are a few souvenirs in the Henry Collection of this important time in Henry's life. One is the photograph (PH. '73), inscribed *nee Frank Wells. Taken 1873–4 in dress of 1803–4* (FIG. 10). Another is a small drawing (too stained and faded to reproduce) inscribed *Where I was engaged to Frank Aug. 1873, at Crapsew, Catskills. E L H.* The engaged couple may be found the next summer sketching together. In Sketchbook 11 (CAT. 1195) there is a drawing of Henry which shows him rowing, with Miss Wells in the stern of the rowboat and a small black dog in the bow; it is inscribed *Near Fort Miller, N. Y., Sept. 4, '74, Friday, 5 p.m.* A sketch in Sketchbook 10 (CAT. 1194) is inscribed *Frank & Peter & little Thompson child in hammock at Thompson's, upper Hudson, Aug. 1874.* Peter is the little black dog. In the same sketchbook, there is a drawing initialed F L H. It is inscribed *Edward L. Henry. Near Fort Miller. Sept. 22d 1874.* A photograph of *The Old Clock on The Stairs* (CAT. 70), pasted on the back of manuscript p. 9 of Mrs Henry's sketch, is inscribed *To Miss Frances M. Wells, 1874.*

Marriage. The Henrys were married in June 1875 (CAT. 117; FIG. 227). The unidentified clipping referred to above gives the following account:

> *Henry and Wells*
>
> *In Johnstown, N. Y., last Thursday morning, Mr Edward L. Henry, N.A., and Miss Frances Livingston Wells, daughter of the late Edward Wells Esq., by the Rev. Charles M. Livingston, uncle of the bride. Mr and Mrs Henry left in the afternoon for New York, received the congratulations of their friends from one till eight p.m., Friday, at the Fifth Avenue Hotel, and sailed for Europe on Saturday in the* Britannic. *They will remain in Europe for a year, spending most of their time in Italy, where Mr Henry will employ his graceful pencil in the pursuit of his art.*

The documents reveal some relatively unimportant discrepancies. Frances L. Wells was born in 1845. After her father's death in 1869, she and her mother moved to New York in 1870 (McCausland '41, p. 208, 229) to stay with her aunt, Mrs Margaret Livingston Murray, who from 1841 to about 1889 kept a boarding house, first on Bleecker street when it was fashionable and then at 24th street and Madison avenue. An uncataloged sketchbook in the Henry Collection is inscribed inside the cover *Fannie Wells, Flushing, L. I., Winter Cottage, 1860–1861.* Were the Wellses in New York this early?

Another interesting minor detail is the fact that Henry bought on April 30, 1872, from A. M. Sypher, 593 Broadway, "2

dimonds," paying $160 for them (DOC. '72). The appraisal of Mrs Henry's jewelry, after her death in 1928, lists, among other items, the following:

1 cluster diamond ring (9 small diamonds)	$60
1 small diamond ring	10
1 three stone diamond ring, old fashioned	250
1 four stone diamond ring, old fashioned	300

Were the "2 dimonds" in this lot?

A third question mark is a letter (CORR. JUNE 25, 1874) from Charles Collins to Henry:

> *Your kind invitation has just reached me . . . It would have been very pleasant to be with you and I hope at some time later to have that privilege. I am glad to believe that you are both in good health again and enjoying your charming home. With my love to Mrs Henry.*

Perhaps the date is a typographical error on the writer's part?

Honeymoon Abroad. There is much visual documentary matter about the Henry's honeymoon. No doubt memories of their ocean trip on the *Britannic* supplied Henry with material for the pen-and-ink drawing *Newly Married* (CAT. 1142). A water color sketch in Sketchbook 13 (CAT. 1197) is possibly a forerunner of the portrait of 1876 (CAT. 122; FIG. 41), which shows Mrs Henry standing at an easel, brush in hand. The water color is inscribed *Mrs E. L. Henry, London, Oct. 1875, by E. L. H.* Recorded in sketches in Sketchbook 13 and also in larger sketches (CAT. 1029, 1052, 1067) is *St John's, Warwick, where we passed two summers,* according to the inscription on a photograph (PH. '75) in the Henry Collection. Other English subjects are commemorated in sketches in the Henry Collection (CAT. 1008, 1009, 1091).

From Warwickshire, the Henry's went to Paris, later returning to England. In Sketchbook 14 (CAT. 1198), inscribed inside the cover in Henry's handwriting *Frances Wells Henry's Sketchbook, London, 1875,* there is one drawing by Mrs Henry, inscribed in her writing *Churchyard, Coventry.* Most of the sketches, however, are clearly by her husband. She continued to draw and paint for a while, even exhibiting at the National Academy of Design in 1885 a painting *Rhododendron,* price $60 (CAT. 1221). This was reincarnated (McCausland '41, p. 92) on the glass doors leading from the living room of the Henrys' Cragsmoor home to the little library. Gradually Frances Wells Henry slipped into the role of wife, whose chief duty was to aid and to admire her husband.

She had not yet been molded, however, to the wifely pattern and may be found noting down her impressions of travel and the British. In Sketchbook 14 (CAT. 1198), we find the following:

> *Sitting here in Boulogne Harbor, what a medley presents itself to my eyes. This poor little boat is already full, mostly English, judging by their broad, harsh accents. Some already looking pale in anticipation of the sea, some jolly & noisy. By me sits a John Bull sort of a man, who has deigned not even a look at me since I so emphatically said,* No, *I'm American. On his other side, a blind man. Here they come, each one looking as if he were the important one on earth, all more or less looking like "Butchers Meat" men.*

Sketchbooks 15 and 16 (CAT. 1199, 1200) contain more notes on travel in France and England. While abroad, the young couple enjoyed various cultural opportunities, among them a *Réunion Musicale,* at the Magasins du Bon Marché in Paris (DOC. July 3, 1875). In Paris, too, they were invited to an "amateur drawing room" at the apartment of Lucy Hooper, wife of Robert Hooper, American vice-consul, in the Rue Neuve des Petits Champs (DOC. '75). Similar incidents of their trip are set down in Mrs Henry's Memorial Sketch, especially the account of their stay with a French family (p. 325*f*).

Married Life. Back in the United States, the Henrys settled down to a comfortable, prosperous middle class existence. Henry did his work, they gave dinners, spent summers with friends on Long Island, lived in expensive quarters. A drawing in Sketchbook 5 (CAT. 1189), inscribed *Dec. 31st, 1880, Tenth St. Studio Building,* shows a woman at the piano and a man leaning against it. This subject is not unlike that of the photograph of the Henrys in their Washington Square studio (FIG. 20). The flute shown in the latter—now in the Henry Collection—reveals Henry's love of music. In the Henry correspondence, there is a letter (CORR. February 26, 1895) inviting the Henrys for the week end, with a postscript that he will not be welcome without his flute.

At this time, Henry spent considerable time with Judge Charles P. Daly and his wife at Sag Harbor. In Sketchbook 16 (CAT. 1200) there is a drawing of Judge Daly and his dog (CF. p. 252); also a sketch of horses at Sag Harbor dated September 6, 1879. A lighthouse, dated 1877, is shown in Sketchbook 17 (CAT. 1201), while in Sketchbook 18 (CAT. 1202) there are several drawings of East Hampton subjects, dating from 1877 to 1880. This gives background for a lost painting which seems from photographs to have been a fine canvas, *East Hampton Beach,* 1881 (CAT. 154; FIG. 49). Henry's method of work is illustrated again in the series of studies for this picture (FIGS. 45–50).

The Henrys and Cragsmoor

The Region. Why the Henrys located at Cragsmoor, known till the late '90's as "The Mountain," records do not show. A certain amount of mystery surrounds the drawing in Sketchbook 5 (CAT. 1189), inscribed *At Mrs Terwilliger's, end of Oct. 1867.* Henry's early visits to the region are not otherwise documented. We know, however, that he visited Professor Weir at West Point (CAT. 2) in 1858. It is not unlikely that he had gone exploring in the Shawangunk mountains before he visited them again and decided to make his home on "The Mountain."

Cragsmoor is about five miles from Ellenville, in southeastern New York in the Shawangunk (pronounced "Shongum") mountains. In recent years, Ellenville has become a center of summer resorts. In Henry's time, however, it was populated only by farmers; he and the artists who followed him were pioneers. Cragsmoor is an arrow-shaped plateau four miles long, overlooking Ellenville and the valley of the Rondout river. It is bounded by Bear hill (FIGS. 79, 80) and Sam's point (FIGS. 14, 15).

Different accounts of the birth of the Cragsmoor colony have been given. The facts seem to be as follows, however. In 1879, the Henrys stayed for a few days at the Bleakley farm on "The Mountain." Mrs Catherine W. Bleakley was already an institution then, taking in summer boarders and being widely known for the quality of her hospitality (McCausland '41, p. 82, 226). A drawing in Sketchbook 5 (CAT. 1189) shows that the Henrys were in Ellenville the next year, being inscribed *Peter & Charley. Sunday June 27 '80, Ellenville.* There is a very interesting small water color in Sketchbook 6 (CAT. 1190), signed lower right *F S Dellenbaugh, 1881,* which shows a blazing fire on Sam's point, frequently set on fire by the huckleberry pickers (McCausland '41, p. 130). A photograph (FIG. 55) in the Henry Collection (PH. '81) is inscribed *in Otis yard 1881.* Dellenbaugh has recorded that the Henrys stayed with the Otises in Ellenville in 1881 (McCausland '41, p. 91, 153 *seq.*, 227-30). Dellenbaugh, who had been with Major J. W. Powell on his second expedition down the Colorado river (Taft '39, p. 288–89), married Harriet Otis, whose memory is still a Cragsmoor legend. Later the Powells stayed in Ellenville, the violinist Maud Powell hiring an empty house on Canal street to practise in (CAT. 319; FIG. 71). A friendship grew up between the Henrys and Maud Powell which lasted throughout life (FIG. 72).

Building a Home. After another trip abroad in 1881 and 1882, witnessed by Sketchbook 19 (CAT. 1203), the Henrys began to build their own home, from plans drawn by Henry, to be seen in Sketchbook 20 (CAT. 1204). According to deeds (DOC. '83) in the Henry Collection, Henry purchased land from Hattie L. Keir on August 3, 1883, paying $200. This property had formerly belonged to the Mance family, descending to George R. Mance from his father, Jacob Mance. Both are immortalized in photographs by Legrand W. Botsford in the Henry Collection. In 1888, Henry bought more land from Mrs Keir for $150. In 1894, he again bought land from her, paying $500. These purchases comprised the Henry property, part of which was sold in 1910 to Julie M. Husson and Mary D. Buxton. The remaining Henry land is now owned by Mr and Mrs R. L. Foster. The Ellenville lawyer, George G. Keeler, central character of Henry's painting *A Country Lawyer* (CAT. 264; FIG. 150), made the original search of title (McCausland '41, p. 137). In addition to the deeds noted, the Henry Collection includes two surveyor's sketch maps of the property, made in 1910. These facts explode the myth that Henry "swapped" paintings for a "hummock of rotten shale" (McCausland '41, p. 145) on "The Mountain."

Henry was his own architect, hiring the local carpenter, "Joe" Mance, to build the house. Mance died in 1896, aged 64. He was a millwright and, according to his son, Stephen D. Mance of Ellenville, "built all the mills around here" (McCausland '41, p. 47, 49). The photograph of Mance (FIG. 134) shows him in back of the Ellenville knife factory, where "Artist Henry" is also said to have hung out. Mance is seen in a number of Henry's Cragsmoor canvases, notably *Joseph E. Mance* (CAT. 193; FIG. 128) and *The Country Carpenter* (CAT. 234; FIG. 145). A letter (CORR. May 5, 1884) from Mance to Henry reads:

> *Mr Henry,*
>
> *I Rec. your Letter. your Door and Frame and Box etc. arived by Canal all in good shape. The Freight is $4 $\frac{1}{00}$ I will git it up to House This week. the Road is quite good. I am going to work at house tomorrow.*
>
> *I have got to get my Brick and Lath and Lime carted up.*
>
> *In Regard to money I whould like to have $300 $\frac{00}{''}$ by the 9th to put things threw as quick as possible.*
>
> *Send money as soon as Can and Oblidge your*
>
> *Frind Joseph E Mance*
>
> *Ellenville, Ulster Co. N. Y.*
> *Rain Today*

The problem of building a home entailed not only financial and practical difficulties, but also esthetic. A quotation from The Summer Haunts of American Artists (Champney '85, 847) published in the Century elaborates the point from the angle of the artist-outsiders. The reference to Henry reads:

> *. . . At Ellenville a group of artists have taken possession of one of the old farm-houses. Here Mr and Mrs E. L. Henry have established themselves. Mr Henry, in building a studio, found great difficulty in impressing his ideas of architecture on the local carpenters. "If you have the rafters show like that," they complained, "and stick the roof all over with little gables, you'll make your studio look like one of them old Dutch manor-houses at Kingston."*

Whether "Artist Henry" won out or not, at least the Henry house did not look like the beautiful old Dutch houses of the region, surely some of the finest vernacular architecture produced in the United States.

A further document in regard to the Henry home at Cragsmoor is a legal paper presented in the summer of 1942 to the New York State Museum by Fred G. Kraft of Cragsmoor, who is the owner of the painting *Pillory and Whipping Post* (CAT. 282). It reads:

> STATE OF NEW YORK
COUNTY OF ULSTER S.S. } *Edward L. Henry being duly sworn says that he is by occupation an artist, formerly resident of No. 3 North Washington Square, New York city and State. That he severed his residence with said New York city on or about the first day of April 1887 and became then and ever since has been a resident of Town of Warwasing, Ulster County, in said State of New York and that he intends to make for the future until further determined his residence at said Town of Warwasing, Ulster County, New York, where he now resides and is a householder and owner of residence and real estate.*
>
> *Sworn before me this 29th day of August 1887* } EDWARD L. HENRY
>
> C. A. VAN WAGENER
NOTARY PUBLIC ULS. CO. NY

Cragsmoor home built, the Henrys settled into a rhythm of living which continued till Henry's death. From early spring to late fall, they lived in the country, going to New York for the winter. Letters and a frantic telegram from Mrs Henry (CORR. '94) record the problem of finding temporary quarters in the city after they had given up their Washington Square studio. Toward the end of Henry's life, they made the Hotel Chelsea their winter

home, except when they went to Florida. Henry's last, unfinished painting is a Florida scene (CAT. 391; FIG. 218), the Henrys having come directly from Daytona to Ellenville where he died. When weather was too bad to open the house up on "The Mountain," they boarded in Ellenville, with Mrs Nelson Terwilliger, at whose home Henry died (McCausland '41, p. 17) and with Mrs John F. Morse.

Cragsmoor Then and Now. Here Henry developed his particular gift of observation into what is his most interesting expression, genre paintings of country life. In the early days when summer people began to visit the community now known as Cragsmoor, conditions were primitive (McCausland '41, p. 146). The stage-coach ran from Newburgh to Kingston, crossing the Shawangunk mountains by the "plank road," now route 52, the Shawangunk trail. It took two hours from Ellenville to Cragsmoor by the "plank road" (McCausland '41, p. 133). The old road followed a different course than the new, the "horseshoe turn" for example having been eliminated. Today one can not see from route 52 the same view Henry painted in *Bear Hill* (CAT. 347; FIG. 79). The old "gully road," shown in several paintings (CAT. 153, 162; FIGS. 137, 139), takes about the same route and seems scarcely less bumpy than when Andrew Carnegie bought one of Henry's paintings as propaganda for better roads in the eastern states (CAT. 247; FIG. 245). Some of the cottages are gone. The Peter P. Brown house (FIG. 78) is visibly altered from the house of 1880 shown in Legrand W. Botsford's photograph (FIG. 77). The mansion of George Inness jr, Chetolah, is now a Roman Catholic home, Vista Maria. Bleakley's barn, home of the first post office on "The Mountain," (CAT. 298; FIG. 81) has been rebuilt into a summer theater. Sam's point no longer boasts Thomas Botsford's Mountain House, famous for fried chicken and green corn. Henry's old home has been remodeled (McCausland '41, p. 166) by its present owners (FIGS. 23, 25). Most of his old friends and artist-confreres are dead (McCausland '41, p. 14). The character of Cragsmoor as an artists' summer colony is changing.

Sixty years ago, Cragsmoor was a different story. Ascent to "The Mountain" from Walker valley was so steep that oxen were used to haul heavy loads, including the community's trunks and food supplies. The climb to the final plateau of Sam's point was up a grade so steep that oxen which *trotted* were used to haul parties to the summit. (McCausland '41, p. 88, 133). Orchards and cornfields covered the top of the plateau. These Henry would

paint in numerous sketches and canvases, particularly his *Four Seasons* (CAT. 372; FIGS. 204–07). Architecture was of an earlier, simpler kind, as the Peter P. Brown house indicates and as does a fine photograph in the Henry Collection (PH. undated) showing a log cabin opposite Tice's, a dwelling of a type more characteristic of the south than of eastern building.

After the proprieties of atelier, Academy and the Tenth Street Studio Building, to say nothing of No. 3 Washington Square North, Cragsmoor must have seemed a wilderness. The Henrys quickly conquered it, imposed their Victorian rococo (FIGS. 21, 22, 24, 26-28) and established a regimen of life composed of charades, readings from the drama by Harriet Otis Dellenbaugh, musicales and teas (McCausland '41, p. 132). Yet there was a poetry in this countryside, surviving even today and recorded in the Dellenbaugh water color, mentioned before (p. 37). Today at sunset, the plateau above Sam's point is a blighted heath, burnt over by fires set by berry pickers (FIG. 18). It stretches out like a plain, but without life—this watershed for the Ellenville water supply (FIG. 17). The romanticist could still find here stimulus for the imagination. How much more so 60 years ago!

Henry's Choice. Henry did not choose to devote himself to the chronicle of nature on Sam's point. An early member of the Cragsmoor colony, Mrs Addison Brown, had first been charmed by the region's wealth of botanical specimens, then brought back her husband and children a decade later (McCausland '41, p. 190). But Henry, though he painted *Bear Hill* (CAT. 347; FIG. 79) and had in his possession photographs of Sam's point (FIG. 14), chose rather to paint life at the lower altitude of Cragsmoor.

The scene Henry found appealing was the rolling slope down from Cragsmoor to the "plank road" (FIGS. 14–16). Legrand W. Botsford, indigenous primitive, made his own naive record of the view Henry expressed in more orthodox style in *Country Scene* (CAT. 233; FIG. 66). To many Botsford's vision will be more acceptable. Nevertheless, in Henry's day the gloss on nature was in demand. Nature was not to be presented as a terrible, uncontrolled force, but as a superior lawn. So, in Henry's landscapes we get so much of the earth and sky as may be compressed within studio walls. Botsford, "the hermit of Cragsmoor," with his innocent eye, kept closer to the real aspect of nature in his photograph of Cragsmoor landscape (FIG. 65). Yet this is, perhaps, saying too little on the credit side for Henry. The undated,

unlocated painting *In The Valley* (CAT. 929; FIG. 83) has a poetic quality, which appears again in *The Country Store* (CAT. 181; FIG. 127). Henry particularly fastened on obvious appeals of the world he chose. *In The Valley* shows the ubiquitous spire of the Ellenville Dutch Reformed Church (FIG. 84), which Henry worked into many scenes, regardless of whether it actually appeared in them in nature.

Henry, however, did not need to be a romantic poet of nature. In the country scenes he found congenial, there was a content of genuine significance and value. At his death, the Ellenville Press wrote in its May 15, 1919, issue that *much of his valuable work has been done in the studio of his mountain residence.* Truly valuable was Henry's work in recording American rural life in one locality, with some revision. His paintings show us today how people, buildings and objects made by people *looked,* and thus Henry supplied a quantity of visual data on the American scene.

The World of Cragsmoor. Life at Cragsmoor was simple. The world was divided into the summer people and the so-called "natives." The "natives" had been there first. But they had to give way to the newcomers, selling them their land and supplying food and services. The Mances, Terwilligers, Deckers, Coddingtons, Kindbergs, Peter P. Brown, Botsfords, Bleakleys, Cooks—these are some of the people who settled "The Mountain" and still live there. Almost all of them appear somewhere or somehow in Henry's work. They built his house, supplied eggs, chickens, butter and milk, plowed his garden, housed and fed the Henrys on flying trips to Cragsmoor before they opened their own house.

A few letters from Cragsmoor survive. They stress tangibly the difference between summer people and "natives," being written on odd scraps of paper and not always too literately. The first, aside from "Joe" Mance's letter already quoted, is from Bleakley. His first name has not showed up in the Henry documents. The letter (CORR. January 3, 1892) reads:

> *Dear Mr Henry*
>
> *Your letter is to hand. Sorry to hear of your sickness. I hope you will soon be all right. It has been a very sickly time. The roof is painted. He wanted more oil and wanted to know your address. But told him you forgot to leave it with me. Nothing new here. Saturday it was very wet all day from five o'clock in the morning. Could not get out all day. Will send bank book so you will get it tomorrow. With kind regards to you and Mrs Henry and wishing a happy New Year.*

A letter from Mrs Keir (CORR. February 20, 1894) has to do with the sale of land mentioned above and reads:

> *Mr Henry—*
>
> *Dear Sir.*
>
> *I am sorry we do not know the dimentions of that lot, as it would save some bother. Mr Mance is not at home or we would get him to measure it for you. Do not forget to mention the ten feet. My given name is Harriet L.*

A note from M. J. Wright to Mrs Henry (CORR. July 29, 1895) portrays the domestic economy of "The Mountain." It reads:

> *My dear Madam—*
>
> *I am sorry I cannot let you have any more eggs, as our hen we have now have chicken and the rest was killed and sold last Saturday.*

A postscript inquires: "Was chicken all right?"

A letter to Mrs Henry from Mrs C. H. Mance (CORR. March 19, 1894) follows:

> *We will try and not let you go off the mountain hungry. Dinner will be ready soon after you arrive here.*

This is annotated in Henry's hand: "Charley Thomas & I came up and dined. Warm, lovely day." What happened to Mrs Henry?

A letter from Thomas Boyce (CORR. March 24, 1896) has more to relate about the Henrys' domestic affairs. It incloses a bill dated November 14, 1895. The letter reads:

> *To*
>
> *Mr E. L. Henry*
>
> *Dear Sir: If it is Convenient to you, would you kindly send me the amount of my Bill. as I need it. It would oblige me very mutch.*
>
> *I hope you and Mrs Henry have Ben well. Wee have had a great deal of sickness here. Mrs Bleakley is not feeling well. We hav had lots of snow. I remain yours*
>
> *Thos Boyce*

The bill, evidently for a summer's supply of milk etc., was for a total of $24.13 and was itemized as follows:

105 qts milk 5 cts pr qt	*5.25*
8 qts ½ Butter Milk 2 cts qt	*.17*
9½ lbs chicken 18 ct lb	*1.71*
11 Loads Manuer 1.50 pr Load	*16.50*
plowing garden 50 cts	*.50*

Finally, the "natives" were the studies from nature for Henry's genre pictures. We find Henry sketching "Joe Mance's" in Sketchbook 22 (CAT. 1206), paying a school tax of $13.50 to Lawrence S. Keir in a note in Sketchbook 25 (CAT. 1209), painting "Old Jimmy Mance" in 1886—a sketch in oil on cardboard in Loose Notes (CAT. 1213). Interested in the picturesque and salable aspect of rural life, Henry went farther afield and exploited Ellenville local characters. The six original oils (CAT. 193, 187, 188, 194, 230, 167; FIGS. 128–33) given by Henry to the village of Ellenville in 1918 and exhibited on August 6th and 7th at the Hunt Memorial Hall in Ellenville for the benefit of the Red Cross—admission 35 cents—are portraits of well-known Ellenville and Cragsmoor people (McCausland '41, p. 42–44, 54–59).

That the countryside responded to Henry's use of local subject matter may be gathered from what the Ellenville Press wrote of this exhibition in its issue of August 8, 1918:

> *It has always been a matter of local pride that so many artists of note have found inspiration and worthy subject matter in our beautiful environs, but with rare exceptions we have not been privileged to enjoy the fruits of their labors. The art exhibition held at Memorial Hall this week marks a notable event in Ellenville's history. . . .*
>
> *The largest exhibitor was Mr E. L. Henry. For many years his friends have looked forward to the annual return of Mr Henry to his mountain home, and perhaps more than any other, we feel that he belongs to us. In a very real sense, he has been our historian and on Tuesday he made the village eternally his debtor by the gift to us of six portraits of well-known local characters painted some time ago, but still remembered. The presentation was made by Mr H. W. Coons and accepted by Mayor Potter for the village and board of trustees. It was a unique and thoughtful gift and cannot fail to be appreciated by those to whom Ellenville and its traditions are dear.*

How much Henry depended on his local subject matter may be judged from a remark in the Cragsmoor Journal for September 12, 1912, to the effect that "Peter's death [Peter P. Brown] was a great loss to Mr Henry, for he had utilized him as a model in some of his most striking pictures. Among these may be named *Uninvited Guests, Peter Brown, Bracing Up, A Hard Road to Travel* (CAT. 169, 187, 168, 162; FIGS. 143, 129, 138, 139).

It is rather interesting that Henry did not use as a subject one of the more unusual Cragsmoor characters, Thomas Botsford (FIG. 16). They are said to have been great friends, Botsford, senior, being uneducated but intelligent. He built a house on Sam's point. which had to be bolted down. At that. it lasted only

one winter. It "blew away, or something," report has it. Then he built below the point itself, setting the second house against the rock wall (FIGS. 14–16). A spring ran through the main room, ferns grew from the walls, and fissures in the rock were chimney flues. In this Botsford anticipated modern architects, who bring natural elements into the interior of dwellings. People from the valley used to come up to dance. For 50 cents they had a wonderful dinner of fried chicken, green corn and ice cream. His son, Legrand (pronounced *Lee*-grand on "The Mountain"), built the road to the top of Sam's point, now a toll road. Botsford, junior, died only a few years ago, leaving behind him the photographic negatives, many of which have supplied illustrations for this report. He, too, painted, but in quite a different spirit than Henry. It is said that he used to take his primitive oils to Henry for criticism. Centainly, the academician could have done little to encourage this child of nature (McCausland, '41, p. 128–30).

The Summer Colony. Who should be credited with being the founder of the Cragsmoor summer colony is a question. Local accounts have given Dellenbaugh the honor, with Henry second. The 1867 entry in Sketchbook 5 (CAT. 1189) mentioned above, however, should certainly raise the question if it were not Henry who introduced every one else to "The Mountain." At any rate, by 1886 the summer colony was well on its way. Mrs Eliza Hartshorn of Newport, a connection of Mrs Henry's on the Livingston side, had begun to buy land and to build at Cragsmoor. She is shown in a sketch in Sketchbook 23 (CAT. 1207), which is inscribed *Mrs Hartshorn of Newport, R. I., taking a rowboat ride on the canal basin below Ellenville, 1910*. In fact, Mrs Hartshorn was the social pivot of life at Cragsmoor, especially as Mrs Henry, the Otis sisters, the Woodruff sisters and Annette Mason Ham were all cousins in different degrees (McCausland '41, p. 40, 86, 207, 227, 229).

The summer colony grew gradually, first, the Henrys and the Dellenbaughs, then Mrs Hartshorn. In 1886 J. G. Brown stayed at the Bleakley farm. Later came Eliza Greatorex, whose property was subsequently sold to George Inness, jr. Then came Edward Gay. Through Dellenbaugh, Charles C. Curran was introduced to "The Mountain," and through him Helen M. Turner came. In its heyday, the colony included Henry, Dellenbaugh, Gay, George Inness, jr, Miss Turner, Keller, Frederick Baker, Carol Brown, Arthur Parton (McCausland '41, p. 127, 130, 131).

Life at Cragsmoor was simple, not only in the structure of the community but also in the character of the pursuits of the summer people. Harriet Otis Dellenbaugh gave readings from Ibsen. The Henrys held teas for the benefit of the Cragsmoor Improvement Association—cause, better roads on "The Mountain." People played croquet, witness Sketchbook 6 (CAT. 1190) and a photograph in the Henry Collection showing Mrs Henry, Dr Howard Crosby and Nicholas Crosby with mallets in hand. Coming up for the summer, the summer colonists left the train at Pine Bush and rode up in carryalls (McCausland, '41, p. 89).

Settling Down. In 1887, the Henrys cut their moorings and made Cragsmoor their real home. This year Henry held the sale of his antiques and paintings which gives a good cross section of his interests (Ortgies '87). Total receipts were $6700.60, according to the annotated catalog (DOC. '87) in the Henry Collection. China, antique furniture, mirrors, clocks, glass, engravings and paintings and a number of works by Henry himself are listed, a total of 258 items. The Henry paintings, 27 in all, brought $2117. None of these has been located. It is possible that No. 53, *Learning the Trade* might be *Sharpening The Saw* (CAT. 195; FIG. 136).

The first decade of life at Cragsmoor was devoted to country scenes. About 1890 Henry began to paint the canal themes which have particular interest in relation to his whole transportation series (FIGS. 156–78). Sketchbook 23 (CAT. 1207), inscribed *Canal Studies,* contains many details of local landscape and village scenes, some still recognizable. The first dated sketch is of the Delaware and Hudson Canal at Ellenville, in Sketchbook 5 (CAT. 1189), this in 1890. The "Old D. and H." canal was a vital fact in the life of the region, in the era before it was outmoded by rail transport (Sciaky '41), and so naturally made an appeal to artists' imagination. Ellenville children played around the locks. Summer people from Cragsmoor "used to have picnics on the canal. They would go up the canal on regular canal boats, towed by horses. It was very, very smelly." Henry loved the canal (p. 330), which as one drove up "The Mountain" and looked back was like a silver ribbon winding through the Rondout valley (McCausland '41, p. 4–5, 59–61, 96, 137, 247).

Henry did not restrict himself to scenes of rural life at Cragsmoor or to canal scenes. He ranged the countryside. In the Henry Collection, there are quantities of photographs of subjects at Napanoch, including some of the "Vernooy Place," featured in

A Wedding in the Early Forties (CAT. 976). There are photographs, too, of the Hoornbeek grist mill at Napanoch which is the subject of a small oil (CAT. 386). Street scenes in Ellenville and Napanoch attest Henry's interest in the document. A fine photograph shows the Rondout at Napanoch, which figures in the titles of several unlocated paintings. Other photographs show the post office at Cragsmoor, the "gully road" and a scene on "The Mountain" with three children in a child's express wagon, the apple trees in blossom on all sides. No doubt, Henry ranged the countryside to a greater extent even than the documents show. Mary M. Woodruff's account of a trip to Bruynswick with the Henrys, in the catalog under *Sunday Morning* (CAT. 283; FIG. 67) suggests this. It was the anecdotal and topical which interested Henry, however, rather than the land itself.

Henry as a Person

Mode of Life. At Cragsmoor Henry settled into a matrix composed of equal parts of work, practical details, social intercourse and the interests related to his paintings—architecture, antiques, photography, music and collecting historic carriages and costumes. Hereafter there would be little change in Henry as a human being, almost none in him as a painter. Note that it is impossible to date his paintings by style after, say *City Point*, 1865–72, (CAT. 96; FIG. 107).

The quality of his life was not extraordinary. Henry refers to a pass to sketch in the Smithsonian Institution (CORR. April 10, 1899). Frederick Dielman, president of the National Academy, writes to thank Henry for information about treating plaster casts with shellac and wax (CORR. March 17, 1907). W. Bradford, "artist painter of icebergs," urges Henry to send work to an exhibition in Minneapolis, on the ground that "last year they sold over $3000 worth!" (CORR. July 21, 1891). Beers Brothers, manufacturers of picture frames at 1264 Broadway, write to Henry about a lost picture (CORR. June 4, 1895) and add:

> *The trouble we think about your pictures is this, you change your address so often . . . . Glad to hear that you are going to send us some money soon as we need all we can get.*

Henry's social life went along on an equally unadventurous level. The Dalys remained his good friends all their lives; they are frequently found corresponding with the Henrys, inviting them to dinner, and so forth (CORR. January 17, 20, 1896). Thomas

Waterman Wood, a president of the Academy, writes to Henry from Springfield (CORR. April 23, 1896). W. J. Havemeyer writes (CORR. February 2, 1896) to make a social appointment. H. W. Bookstaver writes (CORR. April 16, 1891) regarding an appointment for lunch. Abraham Lansing of Albany writes (CORR. December 21, 1894) in regard to a pageant of Albany history. Brother Gilbert of the Order of Brothers of Nazareth writes (June 13, 1896) asking for the loan of sherry or port for the communion service at Cragsmoor. Earlier correspondence (CORR. December 31, 1882) is from Sam Chew, owner of two Henry paintings, *The Reception Given to Lafayette* (CAT. 114) and *The Battle of Germantown* (CAT. 144).

The Cragsmoor rector, Dr Howard Crosby, previously mentioned, writes (CORR. June 19, 1888) to thank Henry for *Corner of Ulster,* adding that "The paper is a capital exhibit of the beauties and wonders of Sam's Point." No clue to this water color has turned up. Other names which appear in the correspondence are H. C. Dallett, G. G. Stow, Mary N. Moran, J. G. Brown, George H. Smillie, Charles Collins, Fred Linus Carroll, F. D. Millet, W. H. Beard, A. R. MacDonough, Richard S. Ely, George H. Galt, Stephen Harris, L. M. McCredy, C. B. Foote, Mrs Lilian Livingston Remsen and scores of others. There is a quantity of autographs cut from their context; and among these we find the names of H. D. Martin, John Rogers, J. G. Brown, Eastman Johnson, Worthington Whittredge and A. D. Shattuck, this last annotated by Henry as follows: "Landscape painter. Gave up Art & Went to Farming. Early in 1870 at Granby, Conn." There are a number of letters thanking Henry for the gift of a photograph of one of his paintings, such as the letter of Elizabeth H. Tobey (CORR. July 1895).

Architecture. Henry's earliest drawings show a keen interest in static forms of buildings. The quantity of photographs and prints on architectural subjects in the Henry Collection indicates how he pursued this interest all his life. The first we can locate is a photograph (FIG. 44) of the Hancock House in Boston, "Taken down (according to Henry's inscription) for common modern houses about 1865." This is, writes A. Hyatt Mayor of the Metropolitan Museum of Art, "the best record I have ever seen of that great lost monument of our early architecture." The photograph was used to document the painting *The John Hancock House* (CAT. 54; FIG. 43).

Photographs by Rockwood of St John's Church on Varick street, taken down about a quarter of a century ago, have a comparable interest. The agitation to demolish this Wren church began soon after the Civil War. There is much evidence in the Henry Collection that Henry fought to mobilize public opinion to preserve historic landmarks. He painted several pictures of St Johns (CAT. 79, 324, 325; FIGS. 112, 247, 248), as well as writing to city officials (CORR. June 6, 1813) and to the Times (p. 215f.). Although Henry often took liberties with the realistic presentment of his subject, nevertheless paintings of this kind have a genuine documentary value, especially when they are buttressed by faithful documents from nature lie the photographs in the Henry Collection.

The sincerity of Henry's interest in architecture is indicated by an appeal made to him in 1870 by William Kulp, an antiquary of Philadelphia (CORR. June 18, 1870) in regard to saving old Newport houses. Kulp himself is documented by an advertisement (CL. '70), in which Martin Brothers, auctioneers, announce a *Sale of Choice Antique Furniture, The Selection of Mr Wm Kulp.* His letter reads in part:

> *I recd your letter this morning. I am sorry you can't come on. It disappoints me. However, it is all right. The next thing that grieves me is about those Newport mansions. Can't you write an eloquent letter praying Mr Fiske for the sake of Art, of all that is sacred from antiquity and more valuable in time to come, that ere it be too late, spare those gorgeous reliques that all the mechanic art of the day can never replace. I realy feel it a duty encumbent upon you to make this effort. It is quite likely if the man has a real insight into the rare merits of these reliques he would spare them. If however nothing can save them, do get the N. Y. Moran to photograph them. Oh, it is most grevious. Why did you tell me when I am so feeble in health?*

What success Henry had the Henry memorabilia do not show. A quarter of a century later he was still interested in the preservation of historic buildings, witness an editorial he saved in regard to the Jumel Mansion, this from the New York Times, January 8, 1903 (CL. '03). It ends with a plea—unquestionably congenial to Henry's own point of view—that the mansion be retained "In a dignified condition, as one of the municipal monuments of a city which has too few."

Henry's interest in architecture found outlet in building his own home at Cragsmoor. In Sketchbook 20 (CAT. 1204) there are plainly recognizable perspective drawings. There are also floor plans and a sketch for a cottage, which must be I-Enia, purchased

in 1910 from Henry by the Misses Husson and Buxton. This house appears in several Henry paintings, notably *The Flower Seller* (CAT. 335; FIG. 194). Henry's love of antiques expressed itself when he brought up, presumably from the Second Avenue wreckers (McCausland '41, p. 132), the carved staircase to be seen at the rear of the photograph of his studio (FIG. 21).

Note, also, a newspaper reproduction (DOC. '04), inscribed by Henry as follows:

> *This Mansion was built for Wm L. Stow in 1893–4 from Designs and Plans by E. L. Henry, N.A. Mr Stow sold it to Cord Meyer about 1900, and* [it] *is now the residence of his widow, 1916. This print was cut from the Herald, 1904.*

A letter from Robert V. S. Sewell (pasted on manuscript p. 55 of Mrs Henry's sketch), dated August 16, 1907, shows that Henry kept up his unofficial architectural work. It reads, in part:

> *The sketches you sent were of the greatest interest to me. I shall try to copy the stair rail, as well as other details in the charming old house.*

A note by Henry adds the information that Sewell was an artist, "building a fine house (time Edward VI) at Oyster Bay."

Antiques. Henry's interest in antiques was of as long standing as his interest in architecture. A letter from Thomas Peterson of Philadelphia (CORR. January 23, 1865) reads:

> *I take pleasure in sending you this day by Kingsley Express freight paid, an antique, which please accept with my compliments. Hoping it may reach you in safety & afford you some gratification.*

The letter was annotated by Henry "Formerly the property of G. M. Dallas, V.P.U. States, [*1792*] a present from the Tycoon, Japan. Perry Exptn 1848." The antique was No. 98 in the Ortgies catalog (Ortgies '87) and was sold for $26. Its description follows:

> *Richly decorated cabinet, with scroll on top, epoch of Louis XIV, presented to the late Hon. Geo. M. Dallas by the Mikado, at the opening treaty with Japan, 1850, U. S. Commissioner with the Com. Perry expedition; purchased at the sale of his effects after Mr Dallas' death.*

Henry often acted as agent for collectors. A letter from him to J. W. Pinchot (CORR. July 1867) gives the details of a transaction in behalf of Pinchot. Purchases included

> *an antique Bureau and Case of Drawers Chipendale style of 1760. And if the man could find you a Sofa same style as the one I have he was to send it along with the others to your address, 6 Courtland Street. The case of Drawers was $50, the Bureau $15.*

Henry embellished the letter with a drawing about an inch and a half high, to describe the case of drawers.

The letter from Kulp above quoted also discusses a piece of furniture Kulp was making for Henry. In 1871, J. W. Drexel wrote (CORR. September 5, 1871) on a letterhead with the address 53 Exchange place, authorizing Henry to draw on him up to the sum of $150. The order reads: "Dear Ned. Go Ahead. I'll back you $150." Henry annotated this: "An order of Joseph W. Drexel to E. L. Henry at Paris to draw on him to purchase some Antiques." In 1872, there is a receipt for an outlay of $20 to buy a bureau (DOC. April 19, 1872).

The Ortgies catalog gives information about Henry's taste in antiques. In his own circle he was established as an authority, and his friends used to consult him about the purchase of antiques (McCausland '41, p. 52). The carved staircase in his Cragsmoor home has been mentioned. He gave the Century Association (CORR. March 9, 1891) a "fine carved mantelpiece, now placed in the Committee Room on the first floor of the new clubhouse." Miss Annette Mason Ham of Cragsmoor and Providence, a connection of Mrs Henry, relates that Henry found much fine wood carving for his friends (McCausland '41, p. 154).

Costumes. Related was his interest in costumes and carriages. Numerous drawings, both in his sketchbooks and in the loose sketches (CAT. 1001 *seq.*), demonstrate this. His collection of costumes was famous. He and Mrs Henry often dressed up for charades (FIG. 31); and he found in his costume cupboard attire for his models to wear in period pictures (FIGS. 74, 76). A letter from J. G. Brown (CORR. December 20, 1895) requests the loan of a costume for his son-in-law. Julian Scott writes (CORR. June 18, 1897) about a coat of 1800, regarding which he wishes information. In Cragsmoor and Ellenville the memory of Henry's costume collection is still green. He had, local report has it, a costume for "every period, every age, child, man and woman" (McCausland '41, p. 21).

The bulk of these costumes went to the Brooklyn Museum in 1921 (CORR. June 16, 1941). Among them were caps, collars and dresses of the 30's, 40's and 50's, a uniform coat from a Connecticut regiment of 1776, men's dress suits of 1840 to 1850, women's dresses of the post-Civil War period, a straw scoop bonnet of 1850, bonnets of horsehair, a child's fancy braid bonnet, and finally a "covered wagon" calash of 1835–50, which inspired a 1940 copy

by a New York designer (McCausland '41, p. 14, 148, 149, 206, 237–43.)

Carriages. Henry's old carriages at Cragsmoor are not listed in the inventory of his estate. There are, however, a number of photographs in the Henry Collection (BIOG. 1900–09), as well as a copy of duties paid at the Port of Albany. The coaches are mentioned in Mrs Henry's Memorial Sketch (p. 331). She gave them in 1922 to the Johnstown Historical Society (FIG. 75). The papier mache horse which Henry used as a model to pose harness on—just as he used the mannequin "Miss Wood" (FIG. 24) for costumes—is now owned by James E. Knox of Johnstown. It is the size of a polo pony or 1600-pound horse, dapple gray, with mouth on hinge. It needs restoration, especially new mane and tail; but it is hard to find "horse painters" these days (McCausland '41, p. 12, 120, 205, 206, 217).

Among the sketches in the Henry Collection a number show Henry's archeological passion for things of the past. Some of the historic vehicles sketched are: *The Lafayette Coach* (CAT. 1051; FIG. 224), *"Rockaway" 1850 to 60* (CAT. 1151), *Old Conestoga Wagon* (CAT. 1143), *Old "Rockaway" 1845 to 60* (CAT. 1144), *Beekman Coach about 1772* (CAT. 1135), *Runabout 1835 to 1845* (CAT. 1152), *"Stage Waggon" of 1821* (CAT. 1155), and a stage which ran from South Ferry, Brooklyn, to East Hampton in the 30's and 40's (CAT. 1153). Other catalog entries having to do with vehicles are: Nos. 1137, 1145, 1154, 1010, 1138, 1157–59. Henry supported his sketches with photographs. The back of General Gansevoort's coach, Governor Bouck's coach or runabout of 1810, the stage which ran from Newburgh to Ellenville (FIG. 55), are some of these objects.

Photography. Hundreds of photographs in the Henry Collection proclaim Henry's interest in photography. Cragsmoor recalls that after his death Mrs Henry broke up two barrels of plates Henry had taken himself. People of Cragsmoor and Ellenville remember "Artist Henry" going about carrying a camera, and especially around the knife factory, so that the snapshot of "Joe" Mance may be Henry's work (FIG. 134). The inventory of his estate lists one large camera at $50 and two small cameras at $3 each. For the most part, he employed professionals to copy his work. A score of 8x10 plates are still at the Shadowland Studios, Ellenville, successor of the photographers of an earlier day, Davis and Tice (FIG. 11). In the Henry Collection there is a 16x20 plate of the painting *A Morning Call* (CAT. 937), the negative being

the gift of the Misses Husson and Buxton. This seems to be the only survivor of Henry's photographic hobby. The prints listed in the Klackner catalogs (Klackner '06), are many of them platinotypes or photogravures made from 16x20 plates (McCausland '41, p. 11 *seq.* 96, 99, 120).

Two objects in the Henry Collection (p. 208), large photographs mounted on canvas on stretchers, one of them partly colored in oils, raise a question as to how many apparent paintings are in existence, which are actually duplicates made by semi-mechanical means. Henry was, however, merely anticipating a common practice of painters today when he made use of photographs as notes for his pictures.

Organizations. Henry was not organizationally minded, as we interpret the phrase today, nor was he a "joiner." When he belonged to art societies, it was because membership in these groups conferred prestige, important in the life of an artist who depended on conventional patronage. Membership in the Academy was indispensable to worldly success, though a great painter like Eakins was not elected till he was 56 (Goodrich '33, p. 135). Election to the Century Association (this in 1866) was another accolade. Henry belonged also to painting groups, like the American Water Color Society. He joined the Salmagundi Club in 1901 (CORR. March 16, 1901). Mrs Henry comments in her Memorial Sketch (p. 343) on Henry's feeling about the societies to which he belonged. He was not apparently active in any of them, although he acted on the committee of admissions for the Century (DOC. 1881–83) and gave that club the carved mantelpiece mentioned above (p. 51). In the Henry Collection, there is a New Year's Eve songbook from the Century, dated 1897–98, and inscribed by Henry: "Drinking the old year out and the New Year in" (DOC. 1897–98). As for the National Academy of Design, Henry is to be found in 1863 (DOC. '63), soliciting for its fellowship fund. In 1888 (CORR. January 7, 17, 1888) he made a gift to the Academy's library of some books, including Nash's Old Halls of England, perhaps a source for paintings like *The Grand Hall, Levens* (CAT. 59).

Henry did not take part in art world politics of the time, apparently. He was asked to support Harry Watrous for election as an associate (CORR. April 25, 1894). A circular letter in this year (DOC. July 25, 1894) shows that the Academy was considering selling its replica of the Doges Palace at the corner of Fourth avenue and 23d street. The next year the Academy took

up a subscription to purchase two paintings from William H. Beard (DOC. April 4, 1895), to be presented to the Century, pledges limited to $20. About the same time Beard wrote Henry (CORR. May 5, 25, 1895) on what was evidently a burning issue in the Academy, personnel and policy. His letter follows:

You were not at the Century last eve, and I felt a little nervous. Don't fail to be on hand Wednesday! If we gather our full available strength, we are triumphant! We have nothing to fear but the apathy of our own people. Not all, but if a few fail our cherished institution falls into the hands of these designing pretenders and our opportunity is gone forever.

All the sculptors seem against us. But we still have a goodly majority if all will do as well as Carl Brandt, who is already here from his southern home, and Sellstedt comes from Buffalo, Shattuck from Con., Haseltine is already here and to be with us.

The other party are doing their utmost to elect Dielman president (!), Maynard vice, and get Swain Gifford on the council etc. Their purpose is obvious. They too must succeed now or never! And this is therefore the deciding point of the future of the Academy. Come without fail, and be there at lunch.

Henry apparently did not consider the issue as burning as did Beard. Beard's second letter reads in part:

I think you were quite excusable in not coming down to the meeting under the circumstances . . . Thank heaven, we came out with flying colors! And elected two new Academicians of our own stripe. We got 13 majority over the whole and Wood had 15 over Dielman, two scattering, and this settles it, unless we let go the advantage we have gained through supine neglect. The other party had gathered their full strength and seemed perfectly confident of success. It shows a waning cause when we draw secret votes from the ranks of our opponents. But the tide is turning.

In 1899, however, the "other party" triumphed. A printed list of nominations for officers of the National Academy of Design (DOC. May 10, 1899) shows Dielman slated for president. If Henry was a supporter of the Wood faction, it did not win him an extra privilege to judge from a letter (CORR. March 18, 1898) from Thomas Waterman Wood, quoted later (p. 62).

Other Interests. Other interests of Henry were more personal. His love of music has been mentioned. A letter from a friend (CORR. April 5, 1894) invites the Henrys to spend the evening, but adds: "Do Not Dare to Come without your flute." Henry had a habit of collecting obituaries. Two large scrapbooks of clippings, collected by Henry, were left on the porch of the Henry home at Cragsmoor after his death and ruined by rain (McCausland '41, p. 15). The demolition of old buildings, murders,

divorce cases, articles on church music, are some of the subjects which interested Henry sufficiently so that he saved clippings on them. His flute and music for the flute are in the Henry Collection.

Personality. In person Henry was short and frail. An old friend, Martin E. Albert (FIG. 76), who used to pose for Henry and who owns a number of excellent examples of Henry's work (CAT. 152, 308, 315, 341, 347, 381) is authority for the statement that Henry never weighed over 110 or 115 pounds. He was not apparently much taller than five feet two or three inches, to judge from photographs (FIGS. 5, 24, 31, 32). In later life he settled down to the discreet routine of tableaux (CL. '90) and teas, witness the Cragsmoor Journal of August and September 1912. But in his youth he made the appearance of a gay blade (FIGS. 33, 35, 38). A medley of objects in the Henry Collection gives a composite portrait—a small flask, about four ounces capacity, with the monogram *E L H*; a prayerbook with the name *Edward Henry, 1860* on the cover and inscribed inside the cover "From my friend Frederick A. Guion, September 1860"; Wells family records from Johnstown; the Livingston family coat-of-arms, framed; two fans with ivory ribs; also the flute.

In Henry's 1898 diary (CAT. 1214) there are items of expense for wine, an item which seems to be a bet on the races, and a drinking song, as well as hymns and religious poems. A card of admission to the Newport Casino (DOC. '91) suggests that Henry's passion for horses was not confined to esthetic appreciation. His love of dogs has been referred to, and there are many drawings with the family dogs, Peter and Charley, as chief actors, especially one dated at Ellenville, 1880, in Sketchbook 5 (CAT. 1189). Mrs Henry's niece, Mrs Lawrence Stetson of Johnstown, relates that once when she was to visit the Henrys at Cragsmoor (FIG. 76), her visit was put off because a pet dog had died!

From Henry's Cragsmoor friends and acquaintances, one gets a sense of Henry as a person. There is some conflict of testimony. But outlines are clear. Traits of character frequently mentioned are that he was quick-tempered, swore like a trooper, teased Mrs. Henry a great deal, was somewhat penurious and liked to wear old clothes. He had a parlor trick so remarkable that it is still a legend at Cragsmoor, of "a summer night's electric storm." Regarding Mrs Henry, there is also general agreement. She was "very precise" and "rather prim and proper," while "every one liked Mr Henry." On the other hand, "They were a darling old-fashioned couple, who pretended to quarrel." Or, "Mrs Henry kind of henpecked

the old gentleman. But she just adored him. She worshipped him." A typical Henry joke, reported in Ellenville, was: "I gave Mrs Henry fifty cents last week. I guess she needs some more." (McCausland '41, p. 25, 131, 148).

There was a touch of the practical joker in Henry's character, to judge from *A Private View* (CAT. 334; FIG. 208). The only clue to this painting is a photograph in the possession of Mrs Charles B. Knox of Johnstown, inscribed on the back "A Caricature Exhibition held at the Century Club. This Caricature Picture on the style of dress & hats of 1905–6. *Private View of the Natnl Academy Exhbtn,* showing the Absurdities in Dress." Henry added a legend in the lower righthand corner, under three feathered creatures. It reads "How we Three, a Tumbler Pigeon, a Top Knot Hen, and a Goose, Suggested the Present Styles of A.D. 1905–1906."

Career as an Artist

Honors and Awards. Henry exhibited in the National Academy exhibitions every year from 1859 to 1919, except 1862, 1873 and 1913. Altogether he showed 147 pictures, not counting the years 1920, 1925 and 1942. He exhibited regularly with the American Water Color Society after its formation, showed at his various clubs, and was a particular favorite in the annual Gill exhibitions in Springfield, Mass. (Gill, 1878–1928). From 1878 to 1919, Henry exhibited there on 16 occasions, showing a total of 20 works, many of which must have found their way into Springfield homes though inquiry has located only two (CAT. 139, 162; FIGS. 189, 139).

During his long exhibiting career, Henry received numerous honors of the academic order, including honorable mention at the Paris Universal Exposition of 1889, a medal at the World's Industrial and Cotton Centennial Exposition in New Orleans in 1885, a special medal for his railroad painting (CAT. 257; FIG. 162) shown in the Transportation Building at the Chicago World's Fair of 1893 (CORR. October 10, 1893, pasted on MS. p. 39), a bronze medal at Buffalo in 1901, a silver medal at the South Carolina Inter-State and West Indian Exposition held at Charleston in 1902, and a bronze medal at the St Louis World's Fair of 1904. In the Henry Collection (DOC. '02) there is the certificate of award from the Charleston Exposition for the oil painting *Waiting for the Ferryman* (possibly CAT. 277). Mr and Mrs Charles Peters of Cragsmoor (McCausland '41, p. 179) have presented to the State

Museum Henry's certificate of award at the New Orleans Exposition and his diploma of award at the Paris Exposition, with many other items.

Sales and Success. Election to the Century Association in 1866 and to the National Academy as A.N.A. in 1867 and as N.A. in 1869 started Henry on the road to formal success. His sales up to 1870 have already been noted (p. 30). Throughout his life he found patrons for his art, making steady sales, though for the most part, his sales were not spectacular. Catalogs of the annual Academy exhibitions show that in the years 1880–96 (National Academy of Design, 1859–1919) he priced his work from $125 to $2000. Two canvases are listed at $1000 and $1500; but the median is around $500. Martin E. Albert reported to me that Mrs Henry told him Henry received $15,000 for the large railroad painting now in the Albany Institute of History and Art (CAT. 257; FIG. 162). Henry's 1898 diary (CAT. 1214) notes an item on May 19th, *chk NAD for big church, $1620.* Entries in this diary and the 1899 diary (CAT. 1214) show that he sold water colors as low as $50. A letter from John H. Weiss of Harrisburg (CORR. December 26, 1889) to W. S. Howard and Howard's note to Henry (CORR. December 27, 1889) indicate that Henry received $900 for *Marriage in the Olden Times* (CAT. A–222). An unidentified newspaper clipping among the obituaries pasted in at the end of Mrs Henry's manuscript notes that "*For the Railway Station* [CAT. 58] he received $530, which in 1876 was a price that meant fame and fortune to a rising American painter."

In the two diaries—sole known survivors of Henry's undoubtedly meticulous personal records—there are accounts of the year's sales for 1898 and 1899. In 1898, he received from the sale of *pictures etc.* $2226.60 and from *coupons* $150, a total of $2376.60, against expenditures of $1212. From Klackner royalties, he got $96.85 in three payments. Paintings sold variously at $50, $75, $100 and $135. For a music design for a Mr Hadley Henry was paid $25. The sale of the "big church"—the large canvas now owned by J. G. Myers Hilton of Saugerties, *Sunday Morning* (CAT. 283; FIG. 67)—for the sum of $1620 was certainly a red letter day. This is one of Henry's outstanding canvases, 34 by 62 inches, painted with great attention to detail. The diary further records the history of the work put into this painting by Henry. From January 4th to March 1st, he painted almost every day on the big church, not completing it in time to send to the

Century, but finishing it so that it could go to the Academy on March 9th. In 1899, Henry's total sales were $2037.13, with an additional $400 presumably again from coupons. The item for expenditures is not clear, being either $1731 or $731. Royalties from Klackner came to $132.50. One picture, *A Rainy Day* (CAT. A–293) sold for $435, *Bound to Shine* (CAT. 223) for $100, while a check from the Academy for $270 paid for several unnamed works. This year Henry sold well at the Gill exhibition, with items for *Saturday Morning* (CAT. A–294) at $175 net and for *Off the Main Road* (CAT. 941; FIG. 254) at $75. It is strange that none of these pictures turned up in the Springfield investigations.

Vogue. Henry's success depended not only on popular vogue but also on his willingness to cut his cloth to suit his customers. A letter from H. C. Henry of Minneapolis (CORR. November 30, 1888) suggests the complacence with which successful artists of the period met their market's demand. It reads:

> *I saw a small painting of yours ("Forgotten") at the Exposition here that I desired to have but was too late. I should like a scene from your hands about as follows. The time near sun-rise on a cold winter morning. An open room which may be comfortably furnished with a stove or fireplace, a bed and other furniture. The room and especially the bed are inhabited by a man and his wife. Whether or no there is a baby will depend on you. The unmistakably nightcapped head of the wife plainly appears above the coverings on the front side of the bed. The poor* shivering *husband in his nightgown only & bare feet is building or lighting the fire in the stove or grate. The room is in disorder with the clothing, pants, dresses, boots, shoes etc., scattered about, as thrown off &* stepped out of *the night before. There may be a pair of pants hanging by the suspenders from a chair. I think the marked idea of the painting should be the excessive cold of the morning. A good size window opening out, with glass partly frosted, icicles suspended on the outside, snow covered hills with the morning light just falling on them etc., as you will best know. I am not drawing rigid lines for you to follow, but wish to indicate what I want. Can you do this satisfactorily to your reputation for say $150 or $175 & if so how long would it take you? You have a fine painting on exhibition that I would like if I could afford it (Smith has it on exhibition at the West Hotel.)*
> *P.S. What branch of the Henry family do you belong to?*

The painting referred to in the first sentence may be *Forgotten* (CAT. 208; FIG. 253). Whether "Artist Henry" ever painted the picture according to the Minneapolis Henry's specifications is not known. At any rate, requests for pictures cut to pattern were not unique. In the Peters gift, there is a letter (McCausland '41, p. 175) dated March 16, 1899, from Oliver H. Durrell of Boston

to Henry at 111 East 25th street, New York, which states that the writer is sorry the water color is sold and asks if Henry would paint a similar subject for him in oil, which would remain in a private collection and never go on the market.

Reproductions. The popularity of Henry's kind of art is gauged by the quantity of reproductions of his work made during his lifetime. Many of these are still very much in evidence. Frequently during my field trip in the Cragsmoor-Ellenville country I would be told that Mr or Mrs So-and-So owns a Henry "painting." Investigation almost always showed the alleged "painting" to be a platinotype or photogravure, sometimes colored by hand, sometimes in black and white. As early as 1887, C. Klackner, 7 West 28th street, New York (Klackner '06), was publishing reproductions of Henry's paintings (CL. '87). The demand for Henry prints warranted the publication of a catalog of 12 pages with 40 illustrations and a list of seven titles not illustrated. In the Henry Collection there are three copies of this catalog, which I have not been able to date. In 1906 the Klackner firm published a more elaborate catalog, comprising 16 pages with 80 entries and 60 illustrations. The State Museum owns two of these. According to Martin E. Albert, Klackner bought all the paintings Henry did not immediately sell, and when Mrs Henry did the bargaining, she got top price. Two letters from Klackner to Henry (CORR. March 17, 19, 1894) discuss terms, Henry apparently considering Klackner's offer too low. The records of this firm, now out of existence, are not available, though a nephew, George C. Klackner of the same address, has a number of large Henry prints in fine condition.

Many of the Henry reproductions were colored by hand by Mr and Mrs Henry, and also by a Mrs Anna Saxton Hartshorn of Ellenville (McCausland '41, p. 1, 20, 62). The "big church" painting referred to above was immediately photographed and copyrighted on its completion; and on April 14, 1898, we find Henry noting in his diary that he "colored all day big church print." Among the documents in the Henry Collection are a number of copyright applications, including those for *The Opening of the First Railroad in New York State* (CAT. 257; FIG. 162), *Home from the War* (CAT. A–303) and *The Old Clock on the Stairs* (CAT. 379; FIG. 214) (DOC. April 22, 1893; February 12, 1903; June 27, 1910).

The case for reproductions is made by the unidentified newspaper clipping quoted under *Sunday Morning* (CAT. 283). It reads, in part:

> [The painting] *ought to be engraved, or well printed in colors, so that when the original is in the possession of some private owner, or placed in some public gallery, people who will never have the opportunity to look at it may have a copy to hang in their homes.*

With the objective of a democratic, popular use of art there can only be the most general agreement. Today, artists meet the genuine need for art for the home by working directly in some practical "multiple original" medium, like the recently developed silk screen color print (See 107th Annual Report of the New York State Museum (p. 43.) In Henry's time, however, direct graphic work had fallen into a decline. The ambitious Academy piece was fashionable. The smaller and less conspicuous print was not. Hence, artists depended on indirect, semimechanical methods for the reproduction of their work.

If an objection is to be raised to these reproductions, it is that they lack of the quality of direct multiple original prints. To be sure, there are some good etchings, such as *Near the Brandywine* (CAT. 939; FIG. 243) and the large print of *Sunday Morning* seen at George Klackner's. But on the whole, the platinotype process produced what amounts to a record rather than an esthetic expression. When the large photographs were "water colored" by a number of hands, the result got rather far away from Henry's original color scheme. There is a picture in the Springfield (Mass.) Museum of Fine Arts which was once thought to be a Henry original but now seems to be a print or photograph painted over (CAT. 907). No doubt, focusing of attention on Henry will bring to light many similar instances.

The mere repetition of a subject, however, does not in itself seem unethical. Most artists repeat themselves; and it is only when the style a man employs is realistic or representational that the repetition is glaringly evident. A contemporary of Henry, the very interesting still life painter, William M. Harnett (Downtown Gallery '39) painted the same "nature-vivre" arrangement over and over again in canvases such as *With the New York Times, With the New York Herald, Flute and Times, The Daily Telegraph* and *Public Ledger,* or his numerous violin pictures. As to the ethics of coloring photographs, there is no question at all if the colored photographs are described as such. On the other hand, there may be a need for more common sense than has been shown toward this question. Is it vastly different to use a still photograph to take the place of handcraft drawing or to project by motion picture technic a design on a wall for the mural painter to paint?

The experience of John Kane (Janis '42, p. 78) in coloring photographs gives a somewhat more human orientation to the problem. Kane questioned a narrowly puristic interpretation. In the ultimate effect, probably we had better judge art by its content and communication rather than by its materials and means.

At any rate, the reproductions not only served to spread Henry's name and fame, but from the documentary point of view, they insured that these visual records of life in America have a better than fair chance of surviving the uncertainties of time and social change. Moreover, they filled a need which persists even to today. The use of Henry's paintings on calendars, which began in his lifetime (CAT. 302, 304, 313, 321, 331), continues. Almost life size is the color reproduction of *The 9.45 a.m. Accommodation* (CAT. 65; FIG. 109) used by the West Virginia Pulp and Paper Company on its 1941 calendar. That the appeal of Henry's work is superior to the often sneered at "calendar art" may be gathered from a story told by a museum curator. He, with two well-known photographers, stopped in a west coast saloon for a beer. The only work of art was the above calendar. Sequel: The museum curator liked the painting so much he got a copy of the calendar too! In 1942, the same company reproduced *The Clermont* (CAT. 323-*a*) in an edition of 30,000. An interesting *obiter dictum* connected with this calendar is that the best efforts of the writer and the advertising agency handling the calendars could not locate the painting itself, in spite of the fact that correspondence in the Henry Collection gave what seemed a first class "lead." All this shows that there exists a real audience for Henry's work.

Economic Pressure. The artist's life is not all popularity and affluence, however. A brief sentence in a letter from James Henry Moser (CORR. November 2, 1894) tells another story: "I find it gives me all I want to do to keep the 'pot biling' this year and sometimes I am quite discouraged." Henry himself knew phases of potboiling, such as the music design above-mentioned and the sketch for Ed. E. Ayer (DOC. '77). This was *A Portrait from life by E. L. Henry of the late Edward Ayer, father of Edwd E. Ayer, one of the pioneers of Chicago, taken at Geneva Lake, Wisconsin, 1877.* The drawing was used on the checks drawn by *Ed. E. Ayer, Ties, Telegraph Poles, Post by Cargo* on the North Western National Bank of Chicago and shows the "pioneer" sitting in a rocking chair, cane against his knee. That there were times of economic pressure may be gathered from a letter from George W.

Stow (CORR. May 11, 1895) saying he will be happy to lend Henry $50 and Henry should have asked him before. A letter from Henry to J. H. Smith, dated August 15, 1915, in the possession of Martin E. Albert, advising against the sale of *In the Old Stage Coach Days* (CAT. 341; FIG. 249) reads, in part:

> *That stage picture I considered one of my best works . . . . At present, no one seems to have any money for pictures just now. I haven't sold anything except one small work since last Christmas and all the other artists' complaint is the same except a few portrait painters, and in Europe it is deplorable.*

Waning Reputation. The above quotation seems to imply a gradual decline in reputation and popularity. Lucia Fairchild Fuller A.N.A., writing in Scribner's after Henry's death (Fuller '20), suggests this when she discusses the amalgamation in 1906 of "the National Academy of Design . . . with the Society of American Artists—which was made up of these now successful younger men." She continues:

> *Consequently, an academician, instead of having a right to hang several pictures on the line in every exhibition, was allowed only one picture, and that hung where the hanging committee pleased. . . .*
>
> *As a matter of fact, although during the first years of this regime, Mr Henry's small canvases were sometimes discourteously used, it was not for long. After a picture or two of his had been "skyed" or hung in what is known as the Academy's Morgue (a room lit only by artificial light), back to the light and back to the best gallery they came.*

A letter to Henry (CORR. March 18, 1898) from Thomas Waterman Wood, president of the Academy, suggests that the process of attrition had begun sooner. It reads:

> *You know by our Constitution, the President is carefully excluded from any connection whatever with the Hanging Committee. The place where you hear your picture is hung, would be a very good one if that "cussed" heater was out of the room.*
>
> *I hear that my portrait of Gay is in the South room, and so is his landscape. I will see Weldon in the morning to ascertain if a change can be made, although I am afraid it is too late.*

Henry's Estate. As he grew older, Henry's production slowed up, as well as his sales. At his death, he left only a few canvases, according to Arthur V. Hoornbeek of Ellenville, who appraised the estate (McCausland '41, p. 41). The inventory (McCausland '41, p. 118 *seq.*) made by Raymond G. Cox, Ellenville lawyer, executor of both Mr and Mrs Henry's estates, listed the following paintings at the Milch Galleries in New York:

1 water color	10x12 inches
Reading the Story of Bluebeard (CAT. 145; FIG. 140)	
Waiting for the Stage (CAT. 387; FIG. 216)	7x10 inches
Old St Mark's, Bowery (oil) (CAT. 381; FIG. 215)	25x27 inches

The following were listed as being at the Brooklyn Warehouse Storage Company:

1 frame containing 4 framed paintings, *The Four Seasons* (CAT. 372, 1–4; FIGS. 204–7)	each 6x9 inches
1 large oil painting	
2 life size lay figures	$4
2 easels	
1 black mirror used by artists	

Probated in the Kingston Surrogate's court June 6, 1919, Henry's estate was valued at approximately $10,000 to $11,000 personal property and $5000 real estate. At her death nine years later, Mrs Henry left an estate valued at approximately $47,000. In the inventory of her estate, the following were listed:

2 wax figures		
Old fashioned costumes		
Studies for paintings		
Swords and pistols		
5 studies for paintings		
1 large camera		$50
2 small cameras	each	3
1 large oil painting *Lady*		3
Old cuts, prints, sketches, photos and studies		
Small chest of paints and brushes		
Portfolio of photographs		
Many little sketches, studies, photographs and other details used in his work.		

The bulk of the drawings, photographs, prints and sketches are now in the Henry Collection.

Henry's Death. Henry died in Ellenville at the home of Mrs Nelson Terwilliger on May 11, 1919, having contracted a cold on the train coming up from Florida (McCausland '41, p. 18). He was buried in Johnstown, where Mrs Henry was later also buried. His last painting, unfinished, was *Florida Landscape* (CAT. 391; FIG. 218). Henry's death evoked a flood of tributes, recorded in part below.

Appreciations of Henry

Obituaries. The American Art News wrote in its issue of May 17th, seeking a just evaluation for a kind of painting which had already then gone out of vogue:

> *Some critics have considered Henry more as an illustrator than as a painter as he deals with minute details and carefully finishes his canvases to the end, like his early fellows of the old Hudson River School—but this estimate is hardly a fair one.*

An unidentified newspaper clipping pasted at the end of Mrs Henry's manuscript reads:

> *Only the older generation recalls familiarly the paintings of E. L. Henry . . . . His pictures today are miles out of fashion in manner and subject . . . . In his own metier, Mr Henry had no superior. His simple, homespun genre paintings, too full of precision and detail to suit the tastes of the moment* [1919] *are the best of their kind . . . .*
>
> *The tendency of the day is to slight the fact that every true picture tells a story. The apostles of "art for art's sake" are in the ascendancy. They try to relegate the story-telling picture to the realm of illustration . . . .*
>
> *Mr Henry never failed to tell a story with his pigments and to tell it as well as any one who painted in the same style. It was the style of Meissonier and Knaus, and with them he was one of the great masters of the style into which he never failed to put something that was his own.*

A second unidentified newspaper clipping pasted at the end of Mrs Henry's manuscript reads in part as follows:

> *. . . occupies a place in American art history . . . that is absolutely unique. He is the Washington Irving of a painted "Sketch-Book," the genial and gracious old-school picture chronicler of the nation's colonial period and of the early and middle nineteenth century . . . .*

The recently discovered paintings of Quidor (Baur '42) make the comparison with Washington Irving seem a little inappropriate. This is the advantage of hindsight, however, and should not be held against Henry's critics of a quarter of a century ago. The lack of accurate knowledge which bedevils the student of art is made evident, though, when the obituary goes on to state that Henry produced in all less than 200 works. The catalog of this report—by no means an exhaustive listing—indicates how folk error is spread even about facts of so recent occurrence that they could be checked and verified. The clipping continues:

> *He was slow, not so much from technical virtuosity as from his habit of meticulous documentation in every detail. These pictures occupy places of honor in the principal art museums and historical societies of the country, as well as in many of the best of the conservative private collections of native painting.*

Here is a further error. If the principal art museums and historical societies of the country owned work by Henry in 1919, they have managed to lose it since; for of the 57 American museums of 59 replying to a questionnaire sent out by the New York State Museum in the summer of 1941, none had any paintings by Henry. Public institutions, other than the State Museum, which own work by Henry today are the Metropolitan Museum of Art, the Corcoran Gallery, the Albany Institute of History and Art, the New York Historical Society, the Yale University Art Gallery and the Haggin Memorial Galleries. The notice continues with a remark which sheds light on the critical values of the time:

> *Then the New Moment intervened, and garish impressionism eclipsed the pale-lighted and lavender-shaded canvases [of Henry].*

Finally it ends with what is surely, to our later eyes, a dubious compliment:

> *The technical style of E. L. Henry underwent no change or evolution in the full 50 years of his professional career.*

A third unidentified newspaper clipping pasted at the end of Mrs Henry's manuscript places what probably informed opinion today will consider a more correct value on Henry's work. It is headed *Pictures as History* and reads in part:

> *. . . . a phase of pictorial art too little understood or appreciated . . . pictures as historical records . . . .*
>
> *. As an American social historian, Henry may have failed of recognition in his lifetime . . . But there can be no doubt of the value of his pictures to the social student of future years. Now that St John's Chapel in Varick Street is gone forever, Henry's charming picture of it* (CAT. 79; FIG. 112) *preserves a social and architectural record that American art could ill spare.*

A sound evaluation was expressed by Will Low in the Evening Post (Low '19). His criticism follows in part:

> *His work . . . will remain . . . unique . . . and a typical American product little affected by his early training in France, devoted to the perpetuation of truly national types and forming, when the day comes for its better appreciation, a life work of which an American artist may well be proud . . .*
>
> *With such patriotic interest can we regard Mr Henry's art, that our Metropolitan Museum could hardly undertake a more pious task than assembling a really comprehensive exhibition of his varied work; varied indeed more than is generally realized, though always related to our American life.*
>
> *Without claiming for Mr Henry a dominant place, there are few American artists who have better served their country in preserving for the future the quaint and provincial aspects of a life which has all but disappeared since we have become the melting pot for other races than our own.*

Memorials. The memorial from the annual report of the president, Herbert Adams N.A., read at the annual meeting of the National Academy of Design, April 28, 1920, presents the judgment of his lifelong colleagues. It follows:

> *No one can doubt the peculiar historic interest as well as the genuine charm of the paintings of Edward Lamson Henry—a full-fledged Academician for over half a century. Mr Henry was born in Charleston, South Carolina, January 12, 1841; was elected an associate in 1867; an Academician in 1869. Although he studied in Paris with Gleyre (that same Gleyre who had perhaps more influence upon the art of Whistler than is generally admitted) Mr Henry's art has a characteristic American quality, no doubt enhanced by his subjects, yet not wholly due to them. In depicting on canvas the manners and customs, the inventions and habitations, the politics and pioneering of his native country during the first half of the nineteenth century, Mr Henry stands unrivalled. Surely he may be called the Meissonier of America. His contribution to our art is historic, unique. No other painter approaches him in the delicate delineation of such subjects as "The First American Railway Train" in the Albany Historical Society.*

From the Century Association also came a memorial, printed in Mrs Henry's Memorial Sketch (p. 344). Pasted at the end of her manuscript is a letter to Mrs Henry from H. Bolton Jones, secretary, in behalf of the Artists Fund Society. It reads:

> *I am directed by the Board of Control to convey to you its deepest sympathy in your bereavement and to assure you that the Society feels deeply the loss of one of its honored and beloved members. Mr Henry occupied a unique place among the artists of America and I know of none who can fill it.*

Contemporary Critical Opinion. Appreciation of Henry during his life was not undiscriminating, to judge from various clippings in the Henry Collection. A letter from Frank T. Robinson (CORR. July 25, 1895) inclosed a clipping from the Boston Transcript for Saturday, July 6, 1895. In the article, Robinson has called for the founding of a National Museum of Art which would be a truly *American* institution, devoted to the encouragement of work by living Americans. He also urged the creation of a new post "minister of art for our cabinet" and suggested for the office the president of the Metropolitan Museum of Art, Henry G. Marquand. Evidently he ranked Henry among those deserving of support; for he wrote:

> *Once I get interested in an artist I never let go. Perhaps I like to endorse myself. At all events, I am with you and your future and want to know you personally as I do your efforts on canvas.*

An unidentified newspaper clipping, probably of 1904, discusses Henry's work as follows:

> *. . . a confirmed academician . . . This pupil of Gleyre . . . with the Meissonierlike technique, paints avowedly in a style that is long since out of date; even his old friend J. G. Brown has been influenced by modern ideas caught in the currents of impressionism. Not so Mr Henry. He calmly continues to paint those delicate studies of a vanished epoch in this country with the knowledge of an archeologist . . . . Not so broadly human nor so humorous as W. S. Mount or Eastman Johnson, nevertheless Mr Henry has made his own niche and fills it admirably . . . . This evocation of sweet, brave, old fashioned days when paint was paint and neither poetry or drama, Mr Henry has mastered the secret of, although he seldom dives deeper than, the anecdote.*

Finally, the American Art News may be found writing in 1906, as follows:

> *. . . is in a sense almost the Doyen of American figure and landscape painters. He is really the art historian of American early life and customs, for his pictures have had for their subjects the life of the United States during the late 18th and early 19th centuries. To the depiction of these scenes and times, their quaintness of custom and costume, Mr Henry has given a life of perservering study and research, and his portrayals of such scenes . . . are familiar to the public everywhere through countless reproductions. He is still painting* [this at the age of 65], *and no American collection or exhibition is really complete that has not an example of his able brush.*

Such is the sum of the life and activity of this typical and therefore significant nineteenth century painter.

List of Henry's Addresses

The following list of addresses is taken verbatim from entries in the annual catalogs of the National Academy of Design.

1859	No address
1860	Philadelphia
1861	Now in Rome, Italy
1863	15 Tenth street [New York]
1864	Studio Building, 15 Tenth street
1867	51 West 10th street
1885	3 North Washington square
1887	Ellenville
1888	58 West 57th street
1892	77 West 45th street
1893	35 West 14th street
1894	51 East 59th street
1895	7 West 43d street [Century Association]
1896	111 East 25th street
1899	7 West 43d street [But Henry lived at 111 East 25th street (see McCausland '41, p. 175).]
1900	111 East 25th street
1901	7 West 43d street
1904	222 West 23d street (Hotel Chelsea)
1905	7 West 43d street
1906	222 West 23d street
1907	7 West 43d street
1909	222 West 23d street
1910	"The Chelsea"

The Chelsea Hotel continued to be Henry's New York home until his death, though there are no more entries in the N. A. D. catalogs.

Figure 2 "E. L. Henry. When a young student of art. Taken 1859 in Phila. at the age of 17." (Photograph, Henry Collection, New York State Museum)

Figure 3 Sketch of E. L. Henry by J. G. Brown, 1868. (Henry Collection, New York State Museum)

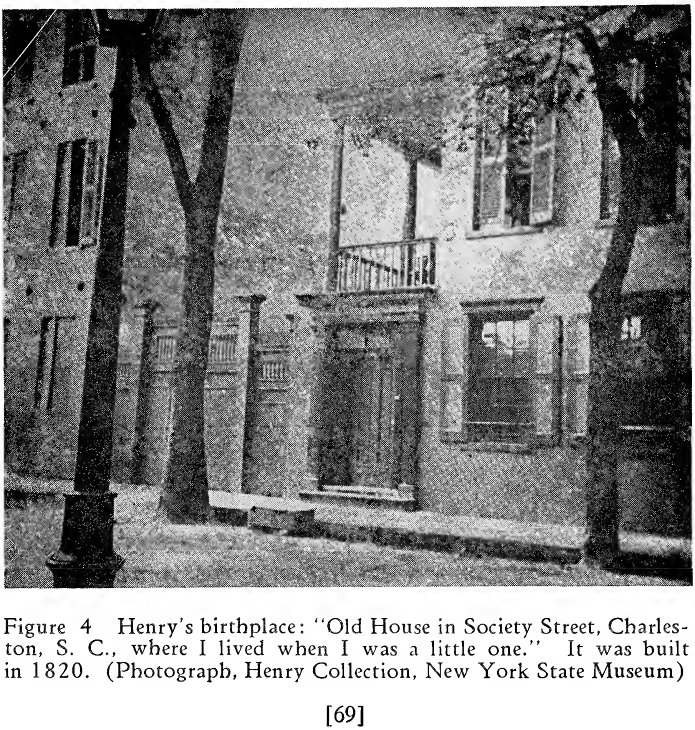


Figure 4 Henry's birthplace: "Old House in Society Street, Charleston, S. C., where I lived when I was a little one." It was built in 1820. (Photograph, Henry Collection, New York State Museum)

Figure 5 E. L. Henry. "Paris taken 1862"

Figure 6 E. L. Henry. "Taken in Phila. 1865"

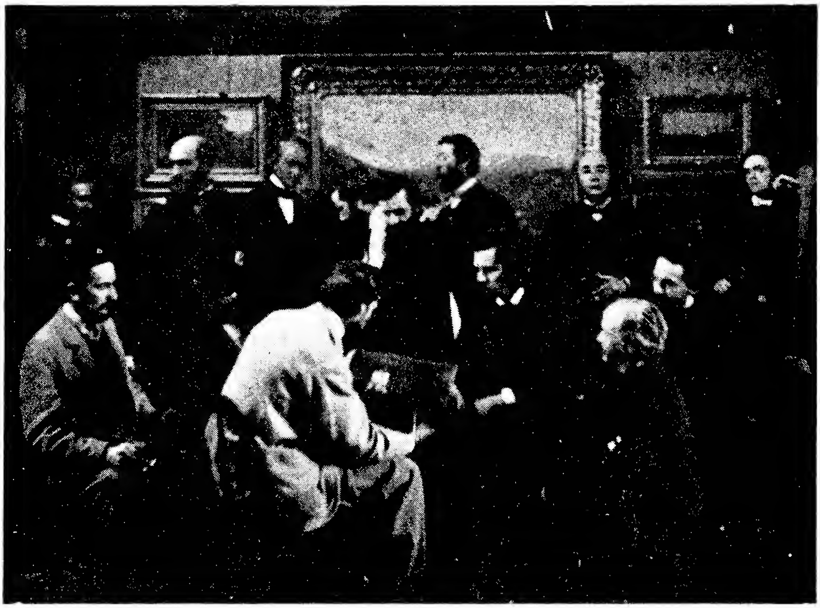


Figure 7 "Taken in Whittredge's Studio, Tenth St. Studio Building, N. Y." (Reading from left to right and alternately from row to row) "Thos. Le Clare, J. F. Weir, Whittredge, Casilear, S. R. Gifford, J. G. Brown, McEntee, Wm Hart, Wm Beard, Regis Gignoux, R. W. Hubbard, S. J. Guy, E. L. Henry—1866. All have passed away (1912) except J. G. Brown, J. F. Weir & E. L. Henry."

Figure 8 Frances Livingston Henry. 1876

Figure 9 Frances Livingston Wells [1867–72 ?]

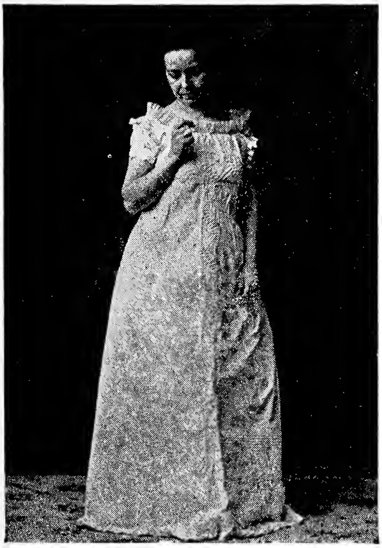


Figure 10 Frances L. Wells, 1873–74, wearing a costume from Henry's collection

Figure 11 Mrs Henry, *circa* 1880 (Tice's Fine Art Studio, Canal street, Ellenville, N. Y.)

Figure 12 "Lake George, Sept. 10th, 1874." Henry is on top of the coach, at the left, wearing a top hat

Figure 13 "Back of Blakeley's on the Mtn. Taken by Robt Blum who died 1903, about 1883. Moi, Frances & little Peter who died Dec. 1884"

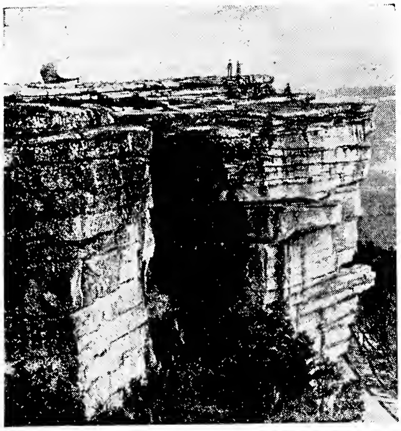


Figure 14 "Sam's Point, 2234 feet, overlooking the Hudson Valley, Cragsmoor, Shawangunk Mountains"

Figure 15 Sam's Point Ledge, November 1907

Figure 16 "Thomas Botsford (born 1824, died 1899) at the old wall, 1891"

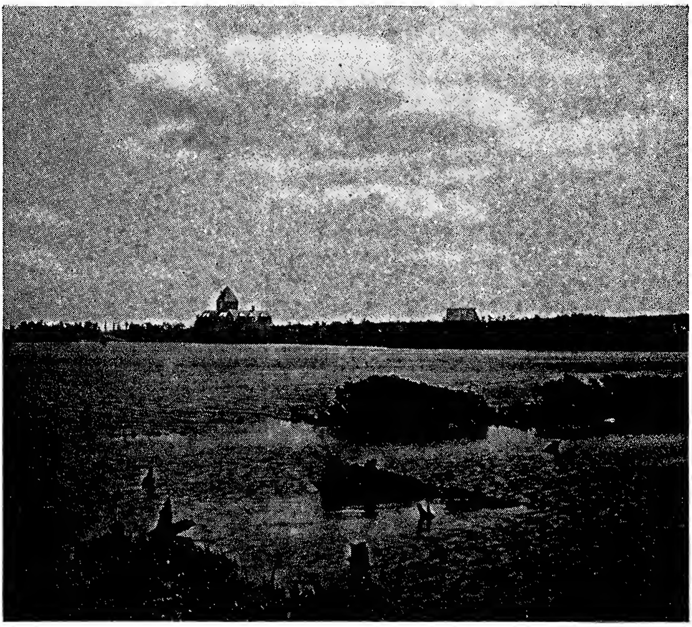


Figure 17 "Maratanza Clouds. Looking south across the lake September '04"

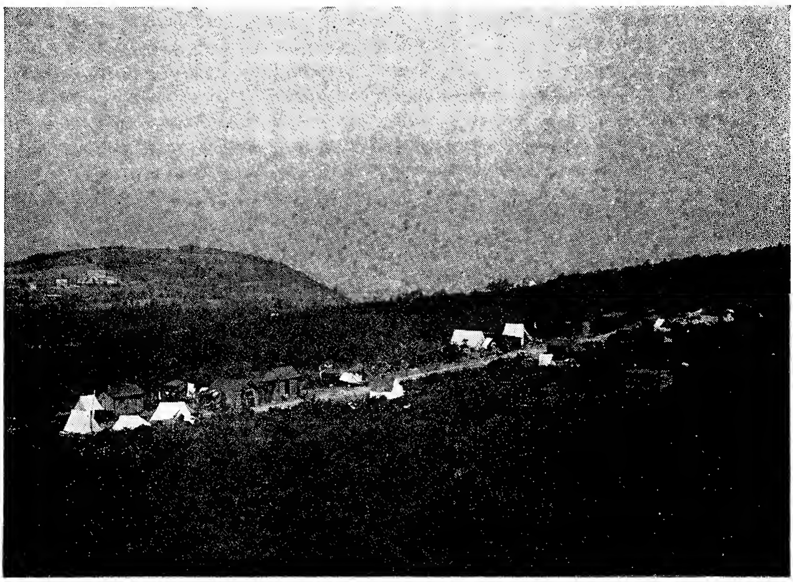


Figure 18 "Pickers Camp, July 1905." Where the migrant huckleberry pickers "squatted" on Sam's Point

Figure 19 "Full of dear memories & where we lived for many years. 218 E. 10th, last of April, 1904."

Figure 20 The Henrys' studio, 3 North Washington square

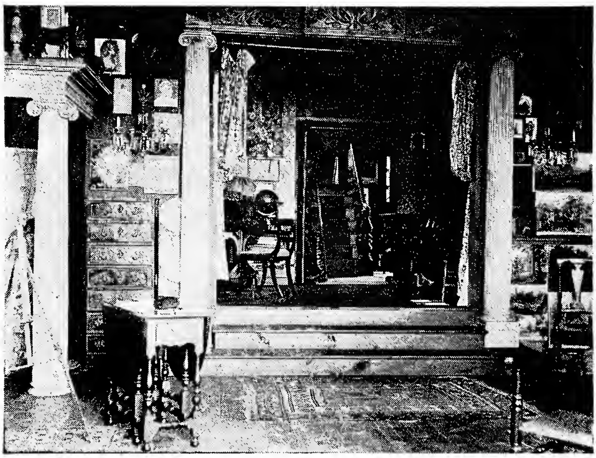


Figure 21 Henry's studio at Cragsmoor. "Newel post 40 inches tall, base 9 inches, □. Carved handrail 30, 17 columns. Small mantle 77 inches long"

Figure 22 The Henry home at Cragsmoor in Henry's time

Figure 23 The Henry home, 1941, now the residence of Mr and Mrs R. L. Foster

Figure 24 Henry at work, *circa* 1917. "Miss Wood," model. looks on. On his easel may be seen *The Floating Bridge,* CAT. 380

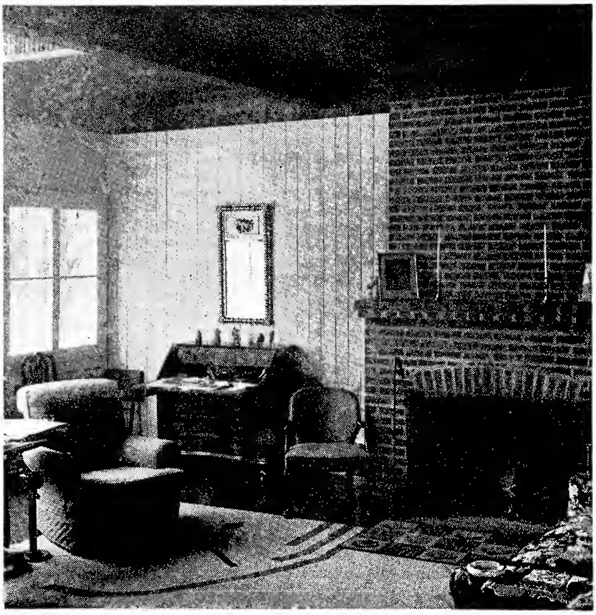


Figure 25 Henry's studio as it looked in 1941

Figure 26 The Henry barn, where Henry had his studio when the Henrys first moved to Cragsmoor

Figure 27 Another view of the Henry house in his day

Figure 28 Henry's garden (Photograph by Jessie Tarbox Beals)

Figure 29 E. L. Henry, 1888: CAT. 1215. A silhouette. Collection, Bernard H. Cone

Figure 30 F. L. Henry, 1888: CAT. 1216. A silhouette. Collection, Bernard H. Cone

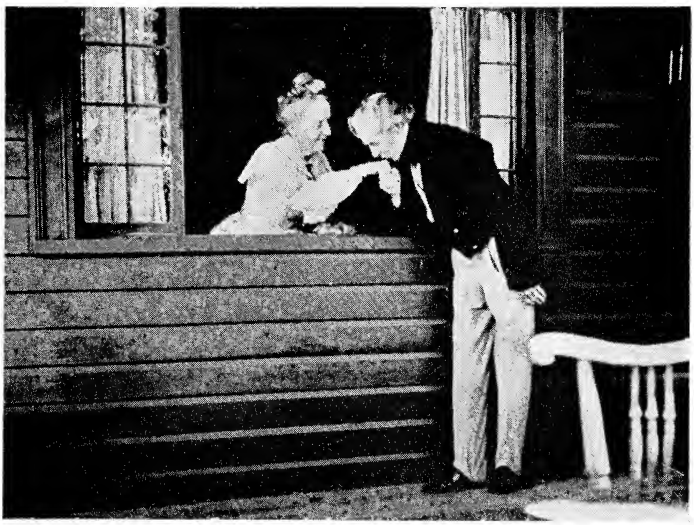


Figure 31 "Mr and Mrs Henry at their cottage. Probably taken by Dr Northrup in August 1910"

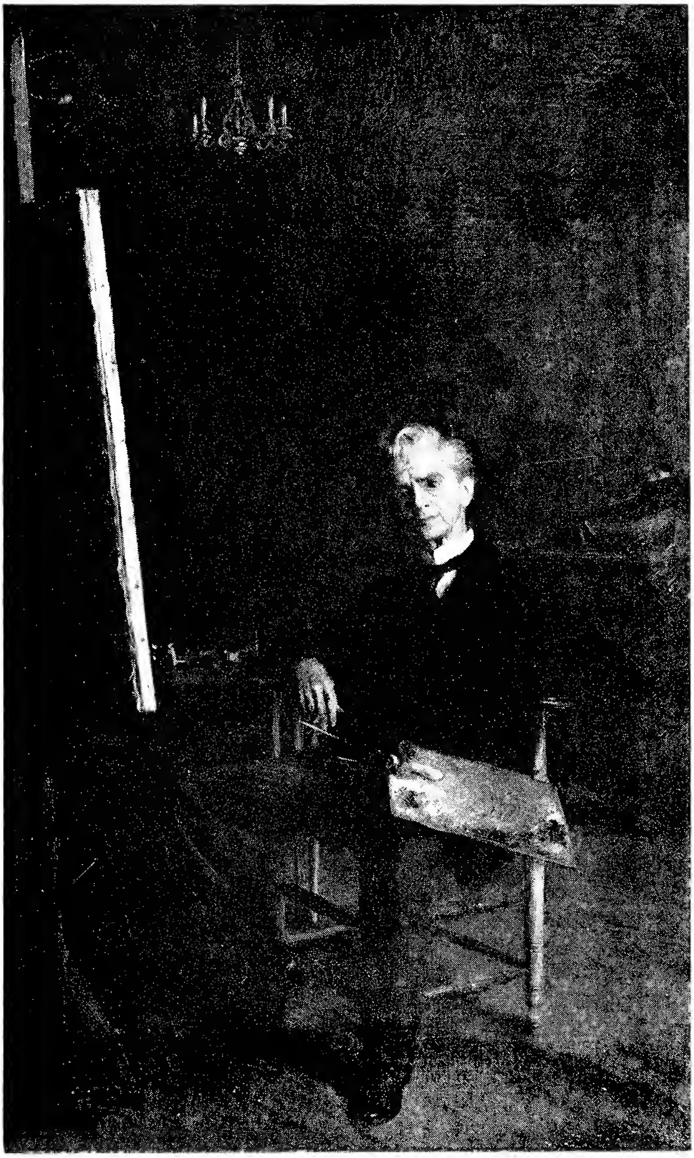


Figure 32 Portrait of E. L. Henry, N.A., by Charles C. Curran, N.A., 1909: CAT. 1220. Collection, New York State Museum

The Work of E. L. Henry

Introduction

THE HENRY CATALOG lists about 150 known oils and water colors in museums and private collections and about 250 oils, water colors and sketches in the Henry Collection, and over 200 paintings are recorded by other evidence. Henry's paintings range in size from 6 by 5 inches—the small portrait of Mrs Henry (CAT. 117; FIG. 227)–to 42¾ by 110 inches—*The First Railway Train on the Mohawk and Hudson Road* (CAT. 257; FIG. 162)—though in the main his pictures were small. Henry worked mostly in oils; however, the catalog lists a number of water colors and black-and-white wash drawings, the latter usually early. A considerable body of work thus exists from which to evaluate his painting.

The exhibition of about 70 of Henry's oils and water colors, held in May 1942 at the Century Association in New York, while not a wholly accurate cross section, afforded an exceptional opportunity to compare his development period by period. Such events —and especially a project like this study and the publication of this report—emphasize the need for re-examination and revaluation of America's typical 19th century academic painters. It would be possible to argue that they fulfilled their function, produced their work, made their contribution, passed into oblivion as their vogue waned, and need not be exhumed. Henry illustrates the cycle; only in the past few years has his name come to notice again. That attitude, however, seems unhistoric, and, indeed, present-day criticism more and more focuses attention on the origins and evolution of American art so that by understanding the roots of native culture we may more successfully encourage living art in America.

The need for re-examination and revaluation of the past, of course, is not confined to the immediate American past. In all fields of human endeavor genius rises from the average or typical activity of the time. The promotion of scholarship leading to humanistic knowledge requires that we more and more survey the characteristic qualities of every country and every craft in every age; such knowledge supplies the background against which continuous human progress may be plotted.

Growing interest in the American tradition has brought critical attention to bear on the minor artists who form the base of average or typical activity on which genius builds. The point is well

formulated in John I. H. Baur's introductory note to the autobiography of Worthington Whittredge (Whittredge '42, p. 5), a contemporary and friend of Henry. Baur writes:

> *Perhaps most interesting . . . is the fact that Whittredge's experiences and ideas come as close to being typical of his time as those of an individual can. The obstacles that he faced in obtaining an art education in the still primitive Middle West, the search for more adequate training in Duesseldorf and Rome, the conscious striving to contribute to the building of a native American school—these were the problems faced by almost every artist of the time, and Whittredge's solutions were, too, those of the majority. He was not a man in conflict with his day, and the Autobiography is in no sense a document of revolt; he was if anything too much of his era for his own good as an artist, but for the same reason the story of his life may well stand as a symbol of the experiences and esthetic judgments of a generation of American painters.*

Holger Cahill makes a further statement of the principle (Cahill '36, p. 18), writing in part as follows:

> *. . . it is not the solitary genius but a sound general movement which maintains art as a vital, functioning part of any cultural scheme. Art is not a matter of rare, occasional masterpieces. The emphasis upon masterpieces is a nineteenth century phenomenon. It is primarily a collector's idea and has little relation to an art movement. When one goes through the galleries of Europe which preserve, in spite of war, fire, flood and other destructive forces, an amazing quantity of works from the past, one is struck by the extraordinary amount of work which was produced in the great periods. During the early part of the twentieth century it is said that some forty thousand artists were at work in Paris. It is doubtful if history will remember more than a dozen or two of these; but it is probable that if the great number of artists had not been working, very few of these two dozen would have been stimulated to creative endeavor. In a genuine art movement a great reservoir of art is created in many forms, both major and minor.*

Not only does present-day critical opinion seek better knowledge of the immediate American past for the sake of throwing light on the present, but particularly it stresses that rediscovery of our tradition necessitates that "periodic revaluation of the past" which Lloyd Goodrich has called "one of the most important functions of criticism." Such revaluation is valuable and indeed essential because the function of time added to experience makes it possible to obtain a clear view of what was not necessarily always seen clearly in its own period; and historical logic may be observed, as clichés, slogans, hypocrisies and mediocrities fall into order. In regard to this study, the forces which beat on artists in the post-Civil War period are plain in retrospect, as is the period's typical

esthetic expression. That expression is described in this report as "the visual, sentimental image," a conception defined in the section on esthetic effects in this chapter. (110 *f*)

The foregoing is a statement of the point of view of this discussion. The thesis that the new patronage for artists after the Civil War helped mold and direct Henry's development as a painter will be considered after his subject matter and method of work have been described and his work placed in the matrix of its period. It may be noted that when a reputation waxes, wanes and revives, the process is likely to be attended by disproportionate judgments. Critics may be found today who totally reject what a painter like Henry represents, while others will say that work of the kind Henry produced is the goal at which painters of our time should aim. It is plain that neither position is just. A study of this character, on the contrary, should endeavor to arrive at a conclusion as to the importance of Henry's painting both in its own time and for today, but especially for the present.

Henry's Subject Matter

Stories in Pictures. Henry's subject matter falls into the two main groups of American genre themes and re-enacted historical events, though as a student abroad and infrequently later in life he painted European scenes. Landscape and portraiture were not his forte. Whatever the subject, he always told a story in pictures; for his was the age of the story-telling picture, and he did not depart from its convention. Essentially, his story was the visual sentimental image, with record values secondary. Typical is the anecdotal *A One-Sided Bargain* (CAT. 305; FIG. 190), which shows a scene at Cragsmoor on the side of the mountain toward Newburgh. Peddler Oliver Evans and his wife, Nancy, who traveled about the countryside with "store goods" and pears, apples, onions and such, are shown dickering with Farmer "Mattie" Wright, a local character, who was still alive on the occasion of the field trip to Cragsmoor in the summer of 1941, but who preferred describing the region's snakes to reminiscing about its old-time artists. Another example is *Food for Scandal* (CAT. 343; FIG. 184). On the back of a photograph of the painting, Henry penciled at some time: "A village girl has picked up a 'Drummer' & invited him out for a Ride in her Buggy." He noted, further: "A sketch of a village News Depot. The old women watching a village girl who has picked up a 'Drummer' and taking him for a

'Buggy Ride.' The oldest saying—'I wouldn't have believed it if I hadn't seed it with mine own eyes. The hussy!'" Has this not the ring of Aunt Samanthy, Mr Dooley and George W. Peck?

Broadly classifying Henry's painting as historical reconstructions and genre, we may list his early student work with his genre subjects, as it deals realistically or naturalistically with everyday scenes. Examples are early drawings (CAT. 1–9, 17) and notes in Sketchbook 1 (CAT. 1185). His Civil War paintings also are observed from nature, as were early American subjects like *Station on "Morris and Essex Railroad"* (CAT. 44; FIG. 108). Henry did not begin to paint historical themes until 1869, and his turning from genre to historical subject matter seems to reflect a changing demand. In the 80's, Henry began to paint Cragsmoor and Negro subjects, his material being derived from direct observation, the former at his summer home and the latter from travels in the South.

Though of greater interest today, Henry's genre subjects are not as well-known as historical works like *The First Railway Train on the Mohawk and Hudson Road* (CAT. 257; FIG. 162) or *The Clermont* (CAT. 323; FIG. 242) or the fine example of Americana, *The 9:45 A. M. Accommodation* (CAT. 65; FIG. 109). A criticism already quoted, from the clipping pasted on page 41 of Mrs Henry's manuscript, states:

> *Perhaps Mr Henry is best known by his pictures of the period following the Revolution, during the latter part of the eighteenth and the early part of the nineteenth century.*

Another clipping, pasted on the back of page 63 of her manuscript, says:

> *Mr Henry is an authority on the costumes and life of early days of the century.*

In view of the growing interest in all kinds of information about the American past, and especially the immediate past, it is probable that Henry's real life subjects will come more and more into vogue. They have more authentic historical status than pictures reassembled, like jigsaw puzzles, from bits of facts, prints, costumes, vehicles and so forth, and they are more expressive.

Student Work. Henry's student work survives in two oils and a number of drawings made before he went abroad in 1860, also the sketchbooks before mentioned. Since much of his work has not been located, it is fortunate that the two oils may be consulted; they are *Barnyard Scene* (CAT. 12; FIG. 92) and *Farm Scene in*

Pennsylvania (CAT. 13; FIG. 93). These are related to the drawings [*Barnyard: 1*] (CAT. 6; FIG. 88), [*Barnyard: 2*] (CAT. 7; FIG. 89), [*Barn Interior*] (CAT. 8; FIG. 90) and [*Barnyard*] (CAT. 11; FIG. 91), as well as to paintings not illustrated or located, *Barnyard Scene Near Philadelphia* (CAT. 9), [*Barnyard Scene*] (CAT. 14) and *Woodpile* (CAT. 15).

That Henry had native talent as well as sound graphic training his student drawings witness. Among these are *Great Bend, Susquèhanna* (CAT. 1; FIG. 85), *West Point from Prof. Weir's* (CAT. 2), *Bethlehem, Pa.* (CAT. 3), *On the Lehigh, Penn.* (CAT. 4), *Mauch Chunk, Pa.* (CAT. 5; FIG. 86), and *Off to Europe* (CAT. 17; FIG. 229), as well as the carefully observed Pennsylvania landscapes and New York City scenes in Sketchbook 1 (CAT. 1185). These drawings, with many others, are in the Henry Collection. There are over 200 sketches and drawings plus the sketchbooks (CAT. 1185–1212), all of which give a good account of Henry's skill and method of work.

Training Abroad. Henry's European training developed his native graphic gift, as may be seen in a series of sketches: *Una Via in Napoli* (CAT. 18; FIG. 94), *The Campagna from Frascati* (CAT. 19), *In Bella Firenze* (CAT. 20; FIG. 233), *Au fond du Lac, Lac du Como* (CAT. 21), *Colico, Lake of Como* (CAT. 22; FIG. 234), *Luino, Lake Maggiore* (CAT. 23), *Livorno* (CAT. 24), *Cannstadt in Württemberg* (CAT. 25; FIG. 235), *In Stuttgart* (CAT. 26; FIG. 236), *A Berlin Omnibus* (CAT. 27; FIG. 237), *Prussian Canal Boat* (CAT. 28; FIG. 238), *In Amsterdam* (CAT. 30; FIG. 239), *Rotterdam* (CAT. 31; FIG. 240), and *Icebergs Off Banks of Newfoundland* (CAT. 32; FIG. 241). The paintings Henry made abroad, during his student years, are not remarkable. They are pertinent, however, as suggesting how American artists felt compelled to pay homage to a foreign ideal. *The Arno, Florence* (CAT. 33) and *Street Scene in Naples* (CAT. 42; FIG. 95) are the only two of this group located to date, though the character of others is visualized in many photographs in the Henry Collection. Probably they showed no great difference in quality; and certainly they expressed a respect for the wonders of the Old World proper in an age when America was beginning to be a nation of innocents abroad.

Civil War Sketches. When Henry began painting, the American genre tradition had not fallen into decline. His Civil War sketchbook (CAT. 1188)—indorsed by him on the cover *War Sketches Oct. & Nov. 1864*—demonstrates how he worked to set down a

literal transcript of nature. The five large pencil and chalk drawings in the Henry Collection minutely detail episodes in Henry's service in the Union Army, as may be noted in the catalog entries, based on the data inscribed on the sketches by Henry. Their titles also suggest what Henry found interesting in the life about him; the drawings are *City Point Oct. 1864* (CAT. 45; FIG. 105), *The Market Place, Washington* (CAT. 46; FIG. 96), *The Great Horse Depot at Giesboro on the Potomac* (CAT. 47; FIG. 97), *Near Harrison's Landing, Lower James River* (CAT. 48; FIG. 98) and *Westover, James River* (CAT. 51; FIG. 102).

In addition, we have located two excellent black-and-white drawings done on the spot, *City Point, Va.* (CAT. 49; FIG. 106) and *U. S. Transport on the Potomac* (CAT. 50), as well as a small oil *On the James River* (CAT. 52). Two fine black-and-white drawings apparently made a few years later are *A New York Regiment Leaving for the Front* (CAT. 66; FIG. 101) and *The Warning* (CAT. 67-*a;* FIG. 104). Henry had not then abandoned that naturalistic style of Americana now particularly appealing to Americans who seek to re-establish connections with the American past. Four canvases have been located dealing with Civil War themes, which were painted after the war. They are *Westover, Va.* (CAT. 57; FIG. 103), *A Presentation of Colors* (CAT. 82; FIG. 100), *The Old Westover Mansion* (CAT. 84) and *City Point, Virginia, Headquarters of General Grant*. (CAT. 96; FIG. 107). Paintings on Civil War themes which have not been located but of which there is record are *Gen. Fitzjohn Porter's Headquarters, James River* (CAT. 74), *After the Battle* (CAT. 75), *Departure for the Seat of War* (CAT. 85) and [*U.S. Transport on the Potomac*] (CAT. 90). *City Point, Virginia* (1865–72), the culmination of Henry's work in this line, is a painting of considerable formal interest, though not perhaps as emotionally evocative as Blythe's *General Doubleday Crossing the Potomac,* illustrated on the same page of Life in America (Metropolitan Museum of Art '39, p. 45). By this time Henry had assimilated his Civil War experiences and was about to pass on to other subjects and styles. Here, he most closely approached his model, Meissonier.

Americana. Before his Civil War service, Henry had begun to paint Americana, applying to that category his habit of observation and exact transcription. The earliest painting of this kind is the unlocated *Station on "Morris and Essex Railroad"* (CAT. 44; FIG. 108), recorded by a photograph in the Henry Album (Henry

1864–68, p. 9). In this painting—which looks from the photograph to be a first-class work—Henry painted in the manner of his early barnyard scenes, from life around him. Was the same quality to be seen in *Russian Fleet at Anchor in the North River* (CAT. 38)? The only record of this painting is a letter written by Henry in 1863 to the Russian consul general in New York (p. 153), offering to present the painting to the Russian government. Though Henry rarely showed interest in politics, his painting this subject and offering it to the Russian government suggests that he responded to general public interest in the visit of the Russian fleet in the critical Civil War years when Russia was one of the United States' best friends (Horwitt '42, Pomeroy '43).

On his return from war service, Henry painted—in 1865—two more American subjects, one of them *The John Hancock House* (CAT. 54; FIG. 43), which has been located, and the other *Residence at Poughkeepsie* (CAT. 55), which has not been located. The Hancock house painting is interesting as showing how Henry combined historical and contemporary subject matter. The records do not say whether or not Henry painted the picture after the house was torn down (p. 128). At any rate he had a photograph of the house taken from the same angle of view as the painting (FIG. 44), which he may have used to document the painting. Probably this canvas should be classed as a historical reconstruction, especially as it is somewhat wooden in feeling. *Residence at Poughkeepsie,* on the other hand, known only through the photograph in the Henry Album (Henry 1864–68, p. 39), is an attractive painting, which one would like to see in order to learn how well it bears scrutiny.

Another unlocated painting, *An American Railroad Station* (CAT. 58), may have been a successor of Henry's first railroad subject, above mentioned, and a forerunner of *The 9.45 a.m. Accommodation* (CAT. 65; FIG. 109), the latter undoubtedly one of Henry's best paintings. About this time, he painted a number of American documents, such as *Porch Scene, Newport* (CAT. 61; FIG. 37), *From a Window, Newport* (CAT. 62; FIG. 34), *Four-in-Hand, Central Park* (CAT. 64; FIG. 38), *The Library of Jonathan Thorne* (CAT. 72; FIG. 39), *A Chat After Meeting* (CAT. 77; FIG. 114), *St John's Church, Varick Street, New York* (CAT. 79; FIG. 112), *St Paul's Church* (CAT. 80; FIG. 113), *Old Dutch Church, New York* (CAT. 83; FIG. 110), *No. 217 E. 10th, N. Y.* (CAT. 97), *A Parlor on Brooklyn Heights* (CAT. 98; FIG. 40), *The Doctor* (CAT. 105; FIG. 116), *St George's Chapel* (CAT. 119; FIG. 111), and *Tenth Street Studio Building* (CAT. 132;

FIG. 258). Henry's visual records of such fine examples of American architecture as St John's, St Paul's and St George's, have historic as well as esthetic value, as do the railroad station pictures. Interiors like *A Parlor on Brooklyn Heights* and *The Library of Jonathan Thorne* record both the exterior fact of American Victorian baroque and the interior fact that they were painted to immortalize their owners and their possessions.

Historical Themes. Henry's historical pictures are foreshadowed in *The Grand Hall, Levens, Westmoreland* (CAT. 59), in which rendering of detail is his chief concern. The first historical reconstruction cataloged is *Graeme Park, Near Philadelphia* (CAT. 86), painted in 1869 on a Revolutionary War theme. In 1871 Henry painted *Independence Hall* (CAT. 91), showing the Declaration of Independence's signers immediately after that event. This painting, Henry's first on an important historical theme, is known only by photographs in the Henry Collection. Henry painted other historical subjects, from 1869 to 1872, including *Lady Elizabeth Ferguson Sending a Letter to Gen. Joseph Reed* (CAT. 92), *A Courtship: Time, 1817* (CAT. 104), *The Meeting of Gen. Washington and Rochambeau* (CAT. 109), [*Colonial Couple*] (CAT. 113), *A Reception Given Lafayette . . . July 20th, 1825* (CAT. 114), *Going Out to Ride: New York, about 1796* (CAT. 115), *William Floyd* (CAT. 130), *The Battle of Germantown* (CAT. 144), [*Revolutionary Scene*] (CAT. 157), *The Battle of Germantown* (CAT. 161) and *Meeting's Out, about 1849* (CAT. 164). None has been located, so that the only visual knowledge of them comes from photographs and reproductions in the Henry Collection. None is especially noteworthy, although the resemblance between Lafayette's face in Henry's picture and in the Morse portraits (Wehle '32, FIGS. 34, 35) may be noted. Did Henry use these for his reconstruction?

English Scenes and Long Island. Before Henry's genre paintings of Cragsmoor, Ellenville and related countryside subjects are discussed, works which do not fit into the general scheme may be noted. His portraits of Mrs Henry, painted in 1875 and 1876 (FIGS. 227, 41), reveal an atypical tenderness. In a few English scenes, notably *Off For the Races* (CAT. 124; FIG. 122), he used material at hand without regard for what proved popular with his American clients. According to Martin E. Albert, Henry's English themes were not particularly salable, as American colonial views were in demand.

A few pictures suggest that Henry had a potential lyric gift. Sketches and paintings made at East Hampton, Long Island, from 1879 to 1881, are well executed and poetic, implying that Henry had a sensitivity to form not always evident in his work. Did he perhaps consult a good model like Boudin? These paintings, none of which has been located except *Old Hook Mill, East Hampton* (CAT. 151; FIG. 126), express light and air, to judge from photographs in the Henry Collection. Two apparently important paintings are *On the Beach: Waiting for the Bathers* (CAT. 140; FIG. 47) and *East Hampton Beach* (CAT. 154; FIG. 49). Should the publication of this report bring these canvases to light, it will be interesting to note how they bear inspection. In the photographs, they seem to have genuine esthetic appeal. Henry's work often looks better in photographs, however, than in actuality, so on this point judgment may be reserved.

In addition, at this time Henry capitalized on the popularity of his railroad station pictures. Two subjects, not located but known from photographs and reproductions, are *The Approaching Train* (CAT. 146) and *The Way Station* (CAT. 147), neither especially interesting. Characteristic of the period was the pressure on artists to repeat successful subjects.

Cragsmoor Genre. At Cragsmoor Henry put down the roots described in the biographical sketch. For two score years, he made Ulster county subject matter his most typically American theme. At the same time he continued to paint historical reconstructions, and as genre petered out around 1900, he gave greater attention to historical subjects. At Cragsmoor he painted the daily routine of a life whose scale was modest. *The Mountain Stage* (CAT. 155; FIG. 54) served the whole countryside, passing through Cragsmoor on its swing around from Newburgh to Kingston. In *The Latest Village Scandal* (CAT. 178), country neighbors in two buckboards pause on a rocky road to gossip. Henry's early Cragsmoor paintings frequently pictured Cragsmoor people, especially Peter P. Brown. Peter Brown fell asleep after noonday dinner, and the chickens came in and walked on the table; see *Uninvited Guests* (CAT. 169; FIG. 143). Brown drank, being by Cragsmoor general report the "village drunk," and Henry painted him *Bracing Up* (CAT. 168; FIG. 138). Other paintings in which Brown figures are *A Mountain Road* (CAT. 153; FIG. 137) and *A Hard Road to Travel* (CAT. 162; FIG. 139), which emphasize pictorial and anecdotal elements rather than plastic. In the latter painting, the carriage and buffalo robe are well painted, but the surrounding

landscape is less successful. An outstanding canvas of this group is Henry's first recorded genre painting on a Cragsmoor subject, *The Summer Boarders* (CAT. 152; FIG. 146), painted in 1881, which shows Mrs Henry and Mrs Hartshorn in a buckboard driven by Brown, coming down the "gully road" from the "Mountain." This is purely a story-telling picture, with local characters, contemporary costume and vehicle, and characteristic Cragsmoor terrain, which depicts everyday life realistically in visual sentimental images.

For the record, the six small paintings presented by Henry to the village of Ellenville may be listed here, again. These are portrait sketches of Ellenville and Cragsmoor characters—John S. Billings, Peter P. Brown, Martin Terwilliger, Joseph E. Mance, Fred Thomas and Aunt Nelly Bloomer (CAT. 167, 187, 188, 193, 194, 230; FIGS. 133, 129, 130, 128, 131, 132). In these he portrayed well-known local people, in characteristic poses and actions, a mood probably closer to genre than to portraiture.

The range of Henry's Cragsmoor subject matter is plotted in an incomplete list of titles, as follows: *The Watering Trough* (CAT. 179; FIG. 151), *Sharpening the Saw* (CAT. 195; FIG. 136), *The Old Forge* (CAT. 200; FIG. 144), *Thanksgiving Sleigh Ride* (CAT. 191; FIG. 152), *Coming from Church* (CAT. 203), *The Mail Stage on the Mountain* (CAT. 206), *The Country Store* (CAT. 181; FIG. 127), *The New Scholar* (CAT. 241), *School's Out* (CAT. 199; FIG. 147), *At The Toll Gate* (CAT. 242), *The Country Carpenter* (CAT. 234; FIG. 145), *On the Old Gully Road* (CAT. 247; FIG. 245), *The County Fair* (CAT. 246; FIG. 182), *The New Woman* (CAT. 253; FIG. 179), *A Country School* (CAT. 232; FIG. 149), *Testing His Age* (CAT. 254; FIG. 192), [*News Office*] (CAT. 263; FIG. 183), *A Country Doctor* (CAT. 189; FIG. 148), *A Country Lawyer* (CAT. 264; FIG. 150), *News of the Nomination* (CAT. 272), *Morning Prayers* (CAT. 273), *A Mountain Post Office* (CAT. 298; FIG. 81), *Talking Politics* (CAT. 299; FIG. 219), *A One-Sided Bargain* (CAT. 305; FIG. 190), *Disturber of the Peace* (CAT. 326; FIG. 177), *The Flower Seller* (CAT. 335; FIG. 194), *Early Autumn* (CAT. 338; FIG. 180), *Taking Life Easy* (CAT. 359; FIG. 52), *The Huckster* (CAT. 370; FIG. 193), *The Bill Collector* (CAT. 365; FIG. 203) and *Contrasts* (CAT. 371; FIG. 178).

Thus Henry covered the gamut from buggy *(On The Old Gully Road)* to bicycle *(The New Woman)* to automobile *(Disturber of the Peace* and *Contrasts)*, making a record of how people lived

in a typical New York State rural community 60 years ago. He visualized the countryside's artisan carpenter and smith at work, neighborhood food supply in numerous marketing pictures, dwellings of wooden frame construction, transportation in buggy, buckboard and stage, farmers at work and stopping to talk of news of the nomination, and a score of similar simple anecdotes of the daily round of life. Especially do Henry's pictures record the slow tempo of farm life before modern mechanization of agriculture: a dozen show the easy, unhurried pace of existence as a bearded old man files his saw or a sun-bonneted young girl goes out to feed the chickens. Working in the fields, men have time to stop and lean on the rail fence and chat with a neighbor passing by. Farmer and wife jog leisurely to town on market day or to meet the train, perhaps to pick up summer boarders at Walker Valley. This life has now been drastically modified by technology. Its portrait is therefore doubly valuable and welcome.

Negro Life. Side by side with Cragsmoor genre subjects, Henry painted themes of Negro life, based on trips to the South, episodes of which are recorded in Mrs Henry's Memorial Sketch (321 *ff.*). In the Henry Collection there are numerous sketches based on direct observation in the field, and there are also casual notes in Henry's sketchbooks. Henry's first known painting on a Negro subject is *A Study in Black and Tans* (CAT. 133), dated 1877, which shows a little girl playing with two brown dogs. Next comes *Reading the Story of Bluebeard* (CAT. 145; FIG. 140), probably painted about 1880. This seems to be a Cragsmoor scene; the same woman and child appear in other Cragsmoor paintings. Though Henry sentimentalized the Negro, nevertheless his frequent use of Negro subject matter is significant as suggesting a widespread interest in Negroes in that period. He painted 30 known pictures in which Negroes appear prominently. Of the sketches in the Henry Collection, three (FIGS. 223, 225 and 226) are reproduced in this report. (Porter, 1943, p. 82 *seq*, 98 *seq*.)

Other paintings on Negro themes listed in the catalog are, in chronological order: *What Am Dat?* (CAT. 182), *Fred Thomas alias Black Fred* (CAT. 194; FIG. 131), *School's Out* (CAT. 199; FIG. 141), [*Taking a Rest*] (CAT. 204; FIG. 124), *A Temperance Preacher* (CAT. 212; FIG. 154), *A Vender of Simples* (CAT. 213), *Smoky Mountains, N. C.* (CAT. 214), *Street Scene, Knoxville, Tenn.* (CAT. 215), [*Family Party*] (CAT. 216), [*Southern Scene*] (CAT. 217), [*A Clean Sweep*] (CAT. 218), *Bound to Cut a Shine* (CAT. 223), *In Doubt* (CAT. 224), [*Young Merchants*]

(CAT. 225), [*Negro Girl Ringing Doorbell*] (CAT. 226), *Happy-Go-Lucky* (CAT. A-241; FIG. 260), *Studying Her Sunday School Lesson* (CAT. 240), *Meditating Revenge* (CAT. 255; FIG. 142), *The Sweetest Fruit* (CAT. 271), *A Virginia Post Office* (CAT. 274), *A Chip Off the Old Block* (CAT. 284), [*Maud Powell Plays The Violin*] (CAT. 319; FIG. 71), *In East Tennessee* (CAT. 337; FIG. 209), *Taking Life Easy* (CAT. 359; FIG. 52). In addition, Negro boys figure in *Capital and Labor* (CAT. 150; FIG. 56) and *Sharpening the Saw* (CAT. 195; FIG. 136), and Negro servants in *The Relay* (CAT. 156; FIG. 157), *A Virginia Wedding* (CAT. 231; FIG. 155), *Waiting at the Ferry* (CAT. 287; FIG. 165) and *News of the War of 1812* (CAT. 366; FIG. 250). The illustrations in this report show how Henry treated his Negro themes.

Henry's Humor. A number of paintings by Henry fall into the category of humor, as judged by the standards of his time. Among these may be named most of the Negro subjects listed above and the following: *Bracing Up* (CAT. 168; FIG. 138), *Uninvited Guests* (CAT. 169; FIG. 143), *The Latest Village Scandal* (CAT. 178), *The New Scholar* (CAT. 241), *The New Woman* (CAT. 253; FIG. 179), *Testing His Age* (CAT. 254; FIG. 192), [*News Office*] (CAT. 263; FIG. 183), *One-Sided Bargain* (CAT. 305; FIG. 190), *A Disturber of the Peace* (CAT. 326; FIG. 177), [*What's That You Say*] (CAT. 328), *A Private View* (CAT. 334; FIG. 208), *Food for Scandal* (CAT. 343; FIG. 184), *The Tramp* (CAT. 364), *The Bill Collector* (CAT. 365; FIG. 203), [*A Dog's Life*] (CAT. 383) and [*A Buggy Ride*] (CAT. 908). Typical, also, is Henry's use of such a detail as the dragging diaper of the baby in *The Pedler* (CAT. 139; FIG. 189).

Transportation. From a record point of view, an important group of paintings is that in which Henry is revealed as a "transportation artist par excellence." He painted vehicles of all kinds, including oxcarts, phaetons, stage coaches, buckboards and buggies, automobiles, early locomotives and railroad coaches, ferry boats, canal packets, ocean liners and bicycles. The number of Henry's paintings on transportation themes suggests that popular enthusiasm for the new inventions, as they came along, created a market for paintings representing such subjects. The motive power of transportation in premotorized days was a favorite theme of Henry's. He loved horses, liked to go to the races at the Newport Casino, and (329 f.) worked both from life, hiring horses from

local farmers to pose them, and from plaster casts. Rare is the canvas in which a horse does not appear in some manner. In the Henry Collection there are a quantity of sketches of horses, drawn from life, in pencil and in oil, some quick notes and others ideas which were not finished. They show excellent observation and draughtsmanship, as well as real feeling for the subject. In regard to vehicles, Henry studied them with great care for exact detail, as is suggested in the section in the biographical sketch on his carriage collection at Cragsmoor (p. 52) and is developed further in this chapter in the section on Henry's method of work.

The now vanished Delaware and Hudson Canal (p. 46) passed practically through Henry's front yard. From the higher elevations of Cragsmoor, it was possible to look down and see its silver ribbon shining in the sun. It quite naturally supplied Henry with material for another chapter in his pictorial history of transportation. Besides the canal sketches (FIGS. 173–76) and the sketchbook devoted to canal studies (CAT. 1207), there are the following paintings on canal subjects: *The Tow Path* (CAT. 249; FIG. 170), *Late Afternoon on the Old Delaware and Hudson Canal* (CAT. 261; FIG. 171), *Scene Along the Delaware and Hudson Canal* (CAT. 342; FIG. 172), *Entering the Lock* (CAT. 289; FIG. 255) and *A Canal Boat Entering a Lock* (CAT. 362). The first two show scenes along the canal in or near Ellenville and can be roughly identified even now, despite changes in the town and the gradual filling in by time of the old canal bed. Architecture in particular has changed little.

Historical Subjects. Henry painted historical subjects all through his working life, turning more and more to this genre as he grew older. Besides the titles previously mentioned, he painted the following pictures on historical themes, reconstructing events from old prints and books and verifying physical detail from actual costumes, vehicles and objects: *Traveling South in the Thirties* (CAT. 170), *A Virginia Wedding* (CAT. 231; FIG. 155), *The First Railway Train on the Mohawk and Hudson Road* (CAT. 257; FIG. 162), *Waiting for the Ferryman: Time About 1844* (CAT. 277), *The Childhood of Rapid Transit* (CAT. 281), *Sunday Morning (Old Church at Bruynswick)* (CAT. 283; FIG. 67), *Crossing the Ferry* (CAT. 288-*a*; FIG. 167), *Indian Queen Inn, Bladensburg, Md., in 1795* (CAT. 290; FIG. 159), *The Battery at New York in 1660* (CAT. 302), *Fulton's First Steam Ferryboat* (CAT. 304; FIG. 168), *Burgoyne's Army on the March to Saratoga, September 1777* (CAT. 306; FIG. 186), *Passing the Outposts*

(CAT. 309; FIG. 185), *Sir Wm Johnson Presenting Medals to the Indian Chiefs of the Six Nations at Johnstown, N. Y., 1772* (CAT. 310), *The Surrender of New York to the English by Stuyvesant, 1664* (CAT. 313), *The MacNett Tavern* (CAT. 317; FIG. 256), *Arrest of Major William Dyre for Treason* (CAT. 321), *The Clermont, Fulton's First Steamboat* (CAT. 323; FIG. 242), *St John's Park and Chapel, New York* (CAT. 324; FIG. 247), *St John's Chapel* (CAT. 325; FIG. 248), *Changing Horses* (CAT. 327; FIG. 160), *Waiting for the New York Boat at Stonington, Conn., the First Railroad from Stonington to Boston* (CAT. 329; FIG. 163), *Residence of Capt. William Kidd, 1691* (CAT. 331), *The Inn at Bladensburg* (CAT. 333), *In the Old Stage Coach Days* (CAT. 341; FIG. 249), *Bear Hill* (CAT. 347; FIG. 80), *Stenton* (CAT. 348), *News of the War of 1812* (CAT. 366; FIG. 250), [*Getting Out the Vote*] (CAT. 368; FIG. 251), *Election Day* (CAT. 373; FIG. 252), *Main Street in Johnstown, N. Y., in 1862* (CAT. 374; FIG. 211), *The Floating Bridge* (CAT. 380; FIG. 213), *St Mark's in the Bowery in the Early Forties* (CAT. 381; FIG. 215), and *Leaving in the Early Morn in a Nor'easter* (CAT. 388; FIG. 161).

Miscellaneous. The above cover the main classes of Henry's subject matter. A painting may be mentioned here which is surely a "sport"—*Les Fosses Communes, Cimitière de St Owen, Paris* (CAT. 128; FIG. 121) painted in 1876. The small pen-and-ink sketch for this canvas (CAT. 128-*a;* FIG. 120) shows how the painting was studied from nature. Dealing as it does with a mass funeral after an epidemic, can it be called Henry's one example of "social content"? Seriously, is it possible that Henry was influenced by Courbet's *Funeral at Ornans,* a very large canvas of a long narrow shape, 10x26 feet, painted in 1850, showing a subject superficially similar? According to Mrs Henry's memorial sketch (p. 314) and to other biographical references, Henry studied with Courbet in Paris. This has always seemed open to question, in view of Courbet's sound plastic and realistic contribution to modern painting. But it may be that Henry was influenced in this instance.

Landscape and portraiture were not Henry's forte, as said before. Nevertheless, besides the portraits of Mrs Henry mentioned above (p. 34 *ff.*), he did produce a few landscapes which are sincere and expressive. Two or three village street scenes have poetic feeling; and it is not exaggeration to state that these paintings—some of them known only from photographs or reproductions—have an

idyllic mood. They represent a romantic quality in Henry of which we know almost nothing from other sources. Among these may be listed: *Main Street, East Hampton, L. I.* (CAT. 163), *A Country Store* (CAT. 181; FIG. 127), *A Village Street* (CAT. 190), *Coming from the Train* (CAT. 207), *Vacation Time* (CAT. 210), *Country Scene* (CAT. 233; FIG. 66), *On the Way to Town* (CAT. 237), *Toward Evening* (CAT. 245), *Village Post Office* (CAT. 248; FIG. 62), *A Village Street* (CAT. 293), and *In the Valley* (CAT. 929; FIG. 83). The small panels *The Four Seasons* (CAT. 372; FIGS. 204–07) illustrate how Henry paid meticulous attention to naturalistic detail, each season having been painted at its appropriate calendar time, according to his note (p. 226). Was this a belated influence of Impressionism, a reminiscence of Monet's haystacks and water lilies? *Old Hook Mill, East Hampton* (CAT. 151; FIG. 126), already mentioned as an example of Henry's best work, belongs here also.

These categories make it clear that above all else Henry was a story-teller in pictures. In so far as he continued to paint pictorial anecdotes when "light and air had become the real subjects of painting"—as Goodrich has written (Whitney Museum of American Art '35, p. 8)—he was an esthetic survival. Before his esthetic expression is considered, however, his method of work may be examined.

Henry's Method of Work

"Meticulous Documentation." Henry collected visual facts with great industry, using as sources sketches, photographs, old prints and written descriptions—a method with which his contemporaries were well acquainted, both personal friends and art critics often referring to his practice. An unidentified newspaper clipping pasted on a blank sheet at the end of Mrs Henry's manuscript, quoted in full in the Biographical Sketch (p. 64), speaks of Henry's "habit of meticulous documentation in every detail." He followed this method to his death, as the late catalog entries show. The data on *The Floating Bridge* (CAT. 380; FIG. 213), begun at the end of the 19th century but finished in 1917, are a case in point.

Henry's method of work was established early in life, as may be read in a letter to Henry (CORR. June 28, 1871) from Frank M. Etting, author of History of Independence Hall and restorer of the State House in Philadelphia in 1876. The letter reads in part:

> *. . . I went immediately . . . to the Sunday Despatch office and examined their files for the picture of the Pine St. House. It turns out that while it was referred to in the text, the picture was a house of Logan's . . . .*

> *Your specialite delights me, and the photographs of your pictures you were so kind as to bring on with you have really* enraptured *many of my antiquarian friends who are anxious to make the acquaintance of the artist, My friend S. C.* [Sam Chew] *wishes to give you a couple of orders when you can execute them, the subjects just such as you will delight to paint and hence they must please every one.*
>
> *I am much in hopes that the city will be induced to order a large painting of the Committee coming out of Independence Hall July 8th, 1776* [see CAT. 91]. *I shall take the liberty in such case to give you a few points about introducting actual likenesses among the spectators that will be consistent chronologically and that will tell upon their descendants* [sic] *of this day . . . .*
>
> *I have found a letter among my Mss of Th. Graeme* [see CAT. 86] *which I have put away for you . . . .*
>
> *We shall certainly go to Stenton* [see CAT. 348] *together when you come on.*

Henry's "habit of meticulous documentation in every detail" was almost apocryphal. Charles C. Curran N.A. relates that Henry drove to Grahamsville—in those days a half day's journey from Cragsmoor by horse and buggy—to verify a special belly band detail (McCausland '41, p. 144). For *The First Railway Train on the Mohawk and Hudson Road* (CAT. 257; FIG. 162) he posed Cragsmoor people, among them Mrs Henry, Harry Cook (McCausland '41, p. 171) and Martin E. Albert, the latter for a man running beside the train and for a coach passenger. Mr Albert, who knew Henry from about 1886 till his death in 1919, reports that Henry worked—in paintings in which horses figure—both from casts of horses' legs and from living equine models, paying local farmers to pose their nags for him.

Henry's Use of Sketches. Henry's working up of specific sketches into paintings has been referred to frequently in this report. *In The Roaring Forties* (CAT. 175; FIG. 57) is based on two drawings in Sketchbook 2 (CAT. 1186), one illustrated in this study (FIG. 60). Henry revised his first draft from nature; for the sketchbook's color notes are not carried out exactly in the painting (see p. 134 *f.*). *Capital and Labor* (CAT. 150; FIG. 56) is documented by a drawing in Sketchbook 3 (CAT. 1187) of a dog and a "dog churn" (FIG. 59). The sketchbooks contain many notes for paintings, already identified. If more paintings had been located, without question more drawings could be matched to them. Sketchbook 24 (CAT. 1208) has a detail for *The Floating Bridge* (CAT. 380; FIG. 213). In Sketchbook 21 (CAT. 1205) there are drawings for *At The Toll Gate* (CAT. 242) and *A Temperance Preacher* (CAT. 212; FIG. 154). Loose Notes (CAT. 1213) has a detail for

the ragpicker's dog cart seen in *St Mark's in the Bowery* (CAT. 381; FIG. 215).

Further sketches for paintings are: Sketchbook 5 (CAT. 1189)—a Negro servant putting a trunk on the back of a carriage, used in *A Wedding in the Early Forties* (CAT. 976); drawings for *Election Day* (CAT. 373; FIG. 252), and [*Getting Out The Vote*] (CAT. 368; FIG. 251), showing *a chimney sweep 1836–7* and *bootblack 1837;* sketch for *A Morning Call* (CAT. 330). Sketchbook 6 (CAT. 1190)—a pen-and-ink drawing for *The Ancestral Home* (CAT. 131). Sketchbook 8 (CAT. 1192)—*Dr H. P. Farnum's visiting Buggy W. 23d St N Y April 1874,* used for *The Doctor* (CAT. 105; FIG. 116), with color notes *silver, yellow line* and *2 yellow lines on Hub & spokes.* Sketchbook 10 (CAT. 1194)—*a dwarf street cleaner working front of St Mark's Stuyvesant St. N Y April 1874, related to St Mark's in the Bowery* (CAT. 381; FIG. 215). Sketchbook 13 (CAT. 1197)—*Mrs E. L. Henry, London Oct. 1875 by E L H* for the portrait done in 1876 (CAT. 122; FIG. 41), and a sketch for *The Departure of the Brighton Coach* (CAT. 136; FIG. 125). Sketchbook 21 (CAT. 1205)—besides details already mentioned, a sketch for *Coming from Church* (CAT. 203). Sketchbook 22 (CAT. 1206)—besides the above comparisons, a sketch for *A Moment of Terror* (CAT. *A*-244); and a scene in front of an inn, related to *Changing Horses* (CAT. 327; FIG. 160). In Sketchbook 23 (CAT. 1207), inscribed *Canal Studies,* there are the following details: *Pumping out the Bilge, On the Tow Path, Hoods on the Mules Heads to Keep the Flies off, A Canal Lock, On the Tow Path, a canal store house and entrance to a lock,* as well as a direct detail for *The Tow Path* (CAT. 249; FIG. 170). In Sketchbook 24 (CAT. 1208), besides the detail mentioned, there is *Fulton's first steam ferry boat. From Paulus Hook (Jersey City) to N. Y. 1813* for the painting of that title (CAT. 304; FIG. 168).

A number of the Henry Collection's larger sketches are related to paintings also, including drawings of mules on the tow path (FIGS. 173–76) used in *The Tow Path* (CAT. 249; FIG. 170). There is also the drawing of a man examining a horse's mouth (FIG. 195) used in *Testing His Age* (CAT. 254; FIG. 192). A fairly complete series is seen in *Beach Wagon* (CAT. 1010; FIG. 45), *On the Beach* (CAT. 1068; FIG. 46), *On the Beach: Waiting for the Bathers* (CAT. 140; FIG. 47), *East Hampton Beach* (FIG. 48), *East Hampton Beach* (CAT. 154; FIG. 49) and *Bathing Hour, East Hampton Beach* (CAT. 154-*a*; FIG. 50).

This method of work explains why Henry did not produce more titles. Entries in his 1898 diary (CAT. 1214) in regard to *Sunday Morning* (CAT. 283; FIG. 67) indicate that from January 4th to March 1st he painted steadily on the canvas, which is one of his largest, being 34x62 inches. A recurring entry is *Painted all day big church*. Later he noted *Big church* pas able *to finish it on time to go to Century on coming Saturday*, then *Nearly finished* and finally *Photo for copyright*. On March 9th he sent the painting to the Academy.

Henry's Use of Photographs. The earliest instance of Henry's using photographs to document a painting is the print in the Henry Collection, inscribed: *The Gap, from the East Side of the River. Evening. No. —— Scenery in the Region of the Delaware Water Gap, Pennsylvania. Photographed by Moran & Storey, Philadelphia.* The view is almost identical with *On the Susquehanna* (CAT. 16; FIG. 87), a painting known only through the photograph of it in Henry's Album (Henry 1864–68, p. 8). Henry probably used photographs collaterally with sketches at this time; for there is a drawing of the same subject (CAT. 1; FIG. 85) in the Henry Collection. Drawings in Sketchbook 1 (CAT. 1185) of New York buses in 1860 are matched by photographs of the same subject in the Henry Collection.

The John Hancock House (CAT. 54; FIG. 43), painted in 1865 —the year it was *taken down for common modern houses*—is documented by a photograph (FIG. 44). Though in the painting the house is considerably foreshortened, the comparison shows how Henry worked for literal accuracy. There are also photographs in the Henry Collection of the end and side views of Graeme Park (see CAT. 86, 92; p. 163 *f.*). Henry went further in the photograph of old Peter P. Brown's house at Cragsmoor (FIG. 77), which he took in 1880. This was copied in 1904 by Legrand W. Botsford, *the figures by the woodpile being playfully painted in, as he* [Henry] *talked of the old days*. Though touched up, the picture supplies a gauge for comparison with the house as it looks today (FIG. 78). Henry used a photograph (FIG. 55) as a detail for *The Mountain Stage* (CAT. 155; FIG. 54). In addition, Dick Elting, probably the driver in the photograph, posed for the picture (McCausland '41, p. 63).

The Henry Collection offers many examples of Henry's use of photographs to document his paintings, among them FIGS. 74 and 76, not yet matched to paintings but obviously made for the

purpose. Both Mrs Stetson and Martin E. Albert (McCausland '41, p. 203, 209) speak of Henry's using them as models (FIG. 76). Cragsmoor reports that Henry frequently took photographs of local people for details (McCausland '41, p. 181). Mrs Charles (Bertha Mance) Peters of Cragsmoor relates that Henry took many photographs of her mother, the late Mrs Charles Mance, to use in paintings. Mrs Peters has a photograph which shows her brother, Ralph Mance, at the wheel of a righthand drive Winton, wearing a chauffeur's cap, and Mrs Henry, in linen duster and veil, in the back seat. The car's registration plate reads "N Y 1914, 89828." In the painting *Contrasts* (CAT. 371; FIG. 178), the number is 18750. A drawing in Sketchbook 25 (CAT. 1209) shows the number as 41744. Thus, though Henry studied visual facts carefully, he altered them as he saw fit. Another drawing in Sketchbook 27 (CAT. 1211) shows a woman in a veil, a driver's cap and a car's brasswork.

Also, compare *Taking Life Easy* (CAT. 359; FIG. 52) and the photograph in the Henry Collection (FIG. 53). In the painting Henry has changed the course of the road; it curves less than in the photograph. The vehicle is slightly different; boards across the rear axle seen in the photograph have been eliminated in the painting. Does this suggest that Henry used photographs or detailed drawings not to obtain a literal transcript but to simplify the manual labor of painting? The photograph of a railroad coach on the Boston and Providence Railroad (FIG. 73) may be a detail for a subject like *Waiting for the New York boat at Stonington, Conn.* (CAT. 329; FIG. 163). The transparency of a corn shock among Legrand W. Botsford's plates (FIG. 82) could well be a detail for the *Autumn* panel of *The Four Seasons* (CAT. 372: 3; FIG. 205), which shows corn shocks in a field.

There are many photographs in the Henry Collection of architectural subjects, including: *Side view "Chew House"; St John's Chapel as Seen from Beach Street; Interior St John's Varick Street, N. Y. Built 1806–7. Taken in 1867. (Rockwood); Stairway City House Built* 1803; *Chase Sitting Room* (with printed data on the back: *H. Schaefer. Photo-Art Studio. 14 Main Str. Annapolis, Md.); Stenton, the seat of James Logan, 1730; Front view "Cliveden"; Hallway "Cliveden."* Probably most of these could be identified from a complete record of Henry's paintings.

As a consequence of his method of work, it is often hard to distinguish a photographic copy of a Henry painting from a direct photograph of the same subject. Some examples are the paintings

recorded in the Henry Album (Henry 1864–68, p. 35, 68) [*Family Party*] (CAT. 216) and [*Southern Scene*] (CAT. 217). One should add here that in this practice Henry had the distinguished company of those two masters of realism, Eakins and Degas (Mayor, 1944).

Henry's Use of Prints and Books. Among the Henry Collection's study materials items which illuminate his approach to painting are chromos of the Brandenburg Gate, the Crystal Palace, the Vatican, Dresden and Vesuvius touched up (perhaps by his own hand?) in pencil and paint. Also among the prints is a photograph of Henry's painting *A Paris Diligence* (CAT. 129) treated the same way. On my field trip at Cragsmoor and Ellenville, in June, 1941, I frequently found touched-up photographs of Henry paintings and was often directed to a treasure cache of his work, only to find the pictures of this kind. A unique item is the print (CAT. 1001; FIG. 51) of Jacques Louis David's *Madame Récamier,* pasted on a wood panel and painted over in oils, David's original composition having been enlarged by the unidentified retoucher's painting beyond the edges of the print. Though the fact that this was done by Henry is not proved, yet the probabilities are that he was the retoucher; for Cragsmoor and Ellenville report on the practice well-known in the community of the two Henrys "water coloring" photographs or other prints of his paintings (p. 52-53, 59).

Henry used historical books, as well as prints, as sources of information. In Sketchbook 20 (CAT. 1204) he noted: "History of First Locomotive of America by Wm H. Brown. Appleton & Co. 1871. (551 Bdwy)." A more extensive note in Sketchbook 22 (CAT. 1206) reads: "Cuzzis Civilis, Or Genteel Designs for Coaches, Chariots, post chaises, etc., vis-a-vis, Whiskeys, single horse chaises, &sc, in the most fashionable taste, colored, engraved on 30 plates, price 10 s & 6, plain 18 s. 1788. Printed and sold by I. Taylor Holborn." In the Henry Album (Henry 1864–68, p. 19) a note in regard to "Lady Elizabeth Ferguson Sending a Letter to Gen. Joseph Reed" (CAT. 92) reads: "Vide Mrs Ellett's Houses of the Revolution, vol. 1, 1828." In his note on *The Floating Bridge* (CAT. 380; FIG. 213; see p. 228-29) Henry writes of using books of travel. The correspondence between Mrs Daly and Henry, quoted under *The Old Lydig House* (CAT. 197; FIG. 58; also FIG. 61) shows how carefully he verified factual visual detail.

The Post-Civil War Period

A Description. E. L. Henry matured as a painter after the Civil War. Thus his working life extended from 1859, the year he first exhibited in the National Academy of Design, to the year of his death, 1919. In time his work spans decades when the United States developed as an industrial nation, and copper, steel, coal and railroads' new rich became art's new patrons. In this span of 60 years, the United States passed from a rural to an urban way of life, and technology became its ruling principle. Modern transportation and communication—foreseen by Henry in primitive forms like *The Clermont* (CAT. 323; FIG. 242) and *The First Railway Train on the Mohawk and Hudson Road* (CAT. 257; FIG. 162)—bloomed into transcontinental limiteds. The Nation moved into full economic independence, world center of financial gravity shifting definitively after the first World War to Wall Street. In this period industrialism became the Nation's established productive system, and wealth concentrated in the hands of industrial entrepreneurs created a new order of patronage.

Henry's painting career, during which he exhibited almost every year in the National Academy of Design, outspanned the *Salon des Refusés* (1863) and the deaths of Cézanne (1906) and of Renoir (1917). In these 60 years the United States produced Ryder, Homer and Eakins (Goodrich '33, '44; Museum of Modern Art '30), as well as scores of painters equally integrated in the American tradition (Baur '40, '42, '42*a*; Metropolitan Museum of Art '39; Whitney Museum of American Art '35, '38, '42). In these years the battle of Impressionism and Cubism was fought. In these years, too, American artists created a body of work on which present-day opinion looks with justified pride. These years are the environment in which Henry evolved. To evaluate him as a painter, it is desirable to understand him as a part of his time. Thus the character of the period, the values which pervaded it and the general role of artists in the age need to be examined.

Looking back on the post-Civil War period, one may note the causes and effects summed up by Holger Cahill (Cahill '36, p. 11 *seq.*) partly as follows:

> *After the Civil War the picture changed completely . . . . The rapid expansion of industrialism made for the dominance of social groups which had no tradition of art patronage and little interest in art except as it might serve as the badge of a newly-acquired social distinction or as an object of conspicuous display . . . . After the Civil War the new generation of art patrons demanded the grandiose, the vulgar, the spectacular, the over-*

> *embellished and the over-genteel—this last as a means of obliterating their crude beginnings . . . . The serious result of this wasteful showiness was less the spread of vulgarity than the dislocation of art in this period from its social context. In a society with such aims there was little place for the creative artist whose concern was with the expression of human experience.*

By implication, the artist who succeeded did so because he was content to express human experience not at all or on the level of shallow thinking and feeling.

Add to "insecurity of taste" (Cahill '36, p. 15) a parallel insecurity in the sources of income on which an American artist of the time might count. Eastman Johnson's abandonment of genre subjects for portrait commissions is explained by John I. H. Baur on the basis of financial necessity (Baur '40, p. 25, 27). The new patrons wanted portraits, but not paintings of everyday life. Thus the "genteel tradition," as Cahill has called it, operated as the aegis under which American painters of the time perforce worked.

The Period's Visual Aspect. The quality of the time may be gauged by its visual aspect. To 20th century eyes, it was elaborate, costly, ostentatious, making appeal by material show. Conspicuous display was, as Cahill writes, the hallmark of late 19th century taste. The period has been pictured by Isham (Isham '27, p. 260) as follows:

> *They gratified themselves with fast trotters, diamonds and champagne; they built themselves big and amazingly ugly houses and filled them with furniture whose only excuse was its cost. And with other things they bought pictures.*

For visual witness, see Mrs A. D. Jessup's rig and T. A. Vyse's four-in-hand (FIGS. 36, 38) in regard to "fast trotters"; for "big and amazingly ugly houses," see Vyse's and Jessup's Newport residences (FIGS. 35, 37); and for "furniture whose only excuse was its cost," see the crowded Victorian parlors (FIGS. 39, 40).

About this time, the Henrys gave a reception for Mr and Mrs Ernest Parton of London (Cl. undated), an occasion when their studio was reported to be hung with flags and its corners banked with palms 20 feet high. Wealthy folk had their horses photographed in front of painted backdrops showing balustered terraces, with barouche and liveried footmen; two such photographs are in the Henry collection (PH. undated). The look of the time may be studied in *In the National Academy,* (FIG. 42), a wood engraving by William St J. Harper, published in Harper's Weekly of April 29, 1882; in it bustles parallel walls crowded three rows deep with

ornately framed paintings. Henry's carved walnut frame, now on the portrait of Mrs Henry (CAT. 122; FIG. 41) in the New York State Museum, is typical. The frame was evidently a favorite of his; it is seen in numerous photographs of his studio building and Washington Square quarters.

The Period's Values. Inevitably the vast increase in wealth in the United States after the Civil War, the growing popularity of European travel, the importation by the new millionaires of foreign art—pointed out by Lloyd Goodrich in his essay on American genre (Whitney Museum of American Art '35)—affected American art and artists. From early American folk painters to Mount (Baur '42) genre had flourished in the United States, recording the development of the country in visual terms. Henry's early paintings of American subjects, such as *The 9.45 A.M. Accommodation* (CAT. 65; FIG. 109), were straightforward expressions in this tradition. The new patrons after the Civil War, however, did not seek realism in art. Goodrich (Whitney Museum of American Art '35, p. 7) has described the effect of their patronage as follows:

> *Saloons, painted women and slums would have seemed positively indecent to the art public of the time. The urban burgher preferred his rural scenes, or at the most J. G. Brown's scrubbed newsboys or E. L. Henry's charming little idylls of an earlier New York . . . . Sex was sublimated into sentiment or confined within the range of family virtues.*

The "family virtues" agreeable to "urban burghers" may be studied in the work of a score of academicians, all friends of Henry, among them Arthur Parton, S. J. Guy, Worthington Whittredge, J. W. Casilear, Sanford R. Gifford, Jervis McEntee, William H. Beard, E. Wood Perry, William Hart, William Page, Robert W. Weir, John F. Weir and Benjamin Franklin Reinhart.

Art books of the time record subjects in favor then—Parthenon, Venice canals, Adirondacks sunsets, "Lo, the Poor Indian," scenes along the Nile and the like. Illustrations in American Painters (Sheldon '79) suggest the caliber of the period. Values are implicit also in a statement made by Thomas Moran to Sheldon (Sheldon '79), which follows:

> *Half the foreign stuff that is sold here I feel is a swindle on the public. The works of Jules Breton, L. Knaus, Oswald Achenbach, Meissonier and Gerome are admirable, to be sure; but I can't think anything of Corot.*

The protest against support for foreign art which discriminated against American artists was justified. It is difficult, however, to

agree with Moran's judgment of "admirable" European painters. In the decade in which he uttered his opinion, Monet, Manet and Degas were at work. The heritage of French painting, from Géricault and Delacroix to Corot and the Impressionists, was available to the United States' art patrons. What they collected is therefore a measure of taste at that time.

An agreeable story in pictures was what was chiefly wanted. W. J. Lampton, writing to Henry (CORR. '00?), emphasizes "pictures that would paint well and pay well" and specifies the story element:

> *I don't know anything about Art—with a big A—but I know what I like in pictures, and for a long time I have been scrapping with my artist friends because they persist in painting things that call for a plan and specifications when there are so many things that tell their own story, as soon as the artist gets them on canvas.*

Art patrons also expected artists to agree with their political ideas. The letter to Henry from May A. Bookstaver (p. 195), headed Pembroke West, Bryn Mawr, October 22, 1896, suggests that Henry's connections were with people of conservative political opinion. This, too, would affect an artist's expression. Will Low's criticism, quoted at the end of the Biographical Sketch (p. 65), speaks of "a life which has all but disappeared since we have become the melting pot of other races than our own"; and Mrs Henry refers somewhat slightingly, in her Memorial Sketch (p. 325), to the Italian section of New York's lower West Side.

An occasional contemporary statement held out against prevailing standards. Art in America (Benjamin '80, p. 115–16) indorses a criticism of J. G. Brown because he washed his urchins' ears before he posed them. Benjamin criticizes Henry for hardness of outline, then refers approvingly to *Waiting for the Bathers* (possibly CAT. 140; FIG. 47), but gives first place to Winslow Homer and Eastman Johnson for painting truly American genre. Generally, artists found it easiest to conform.

The Period's Taste. The period expressed itself in ways often unacceptable to present-day criterions. Is it likely that the subject described by H. C. Henry of Minneapolis in the letter quoted above (p. 58) would be painted today? The idea of the husband, in nightshirt, shivering in the unheated bedroom etc., is not in our time-spirit. Typical, too, is a poem inscribed "with the compliments of Treadwell Cleveland of Newark Eve. News," a longhand

manuscript, dated at the Hotel Chelsea, March 12, 1918, pasted in Mrs Henry's manuscript Memorial Sketch. The text follows:

Midst fads and shibboleths, and freaky schools
Whose creeds are folly, whose disciples fools,
How gracious glows the brush whose touch sincere
Depicts in truth the beauty all revere,
As pigments from the palette of the skies
Are purely seen through frank and faithful eyes,
And forms, true traced with earnest, humble skill,
Grow quick with art yet breathe of nature still!
As vivid as Meissonier's master stroke,
As fine as Vibert's pencil would evoke,
But more alive, more intimate, more true,
The world that Henry's hand unveils to view.
When Futurist is buried by the Past,
While Cubist molders with his shattered cast,
And all the cults of psychopathic twist
Are blown afar as winds dispel the mist;
When honest sunlight clears the air of art,
And honest craftsmen follow head and heart;
Then homage will be paid to Henry's name
And workmanship will seal his brow with fame.

The tribute is characteristic. The effect of such standards was to enforce conformity. The quality of patronage is mirrored in Art Treasures of America (Strahan '79, II; *c.* 86, *c.* 98, *t.* 82, *t.* 126, III, *c.* 28, *t.* 28), which shows the kind of story-telling picture in vogue. Generally the story favored was an episode from history or mythology, a blurred image of the neoclassicism of David and Ingres, in the main lacking even the appeal of sentimental genre. Among the collectors recorded in this de luxe three-volume subscription set were W. H. Vanderbilt, Fairman Rogers, A. J. Drexel, W. W. Corcoran, T. H. Havemeyer, Mrs A. T. Stewart, J. Pierpont Morgan, who collected Bougereau, Gérôme, Meissonier and the like. Almost no American artists were represented, though some of those named had purchased paintings by Henry. The kind of painting in demand is suggested in an unidentified newspaper clipping (CL. April 3, 1879), which refers to *Old Folks at Home* [*The Old Paternal Home* (CAT. 110; FIG. 119)] as an "uncommonly fine and handsome canvas." The criticism continues:

. . . the refined nature of the artist has imparted, it seems to us, to this picture the very feeling of security and happy contentment which belongs to a well regulated household.

Henry's taste in antiques has been mentioned in connection with the Ortgies sale (p. 46). His taste in literature is suggested by fragments of his library now in the Henry Collection. Among these are the magazines Character Sketches, edited by Marion Harland; Current Literature: A Magazine of Record and Review, The Art Amateur, Paris in the series King's Views, and (1870) Day's Doings: Illustrating Current Events of Romance, Police Reports, Important Trials and Sporting News, also Sporting Times and (1879) The Daily Graphic: An Illustrated Evening Newspaper.

The carved walnut frame in the Henry Collection has been mentioned (p.103). Possibly the painting *From a Window, Newport* (CAT. 62; FIG. 34) inspired its shape. More probably it represented an influence from the vogue for Romanesque which Richardson brought into architecture, to have it echoed in buildings as different as Post's New York Produce Exchange Building and a Brooklyn coffee warehouse (Abbott '39, p. 20–21, 200–1). Although today round and oval shapes are out of favor, this frame indicates an esthetic preference in Henry, as does the long, narrow horizontal he often used. About the only statement from him on a matter of taste has to do with a suitable frame for *Spring* (CAT. 315). A letter from Henry to Martin E. Albert, dated "On Mtn June 14th, 1904," reads in part:

> *It is one of my strongest little pictures, I feel. I thought of framing it in a black ebonized frame with gilt flat next to canvass* [sic], *feeling that the dark wood helped to make the contrast greater like looking out of doors from a window. They are more durable and far more effective than gilt. If you don't want it, preferring a gilt frame, you can have your choice, as the frame is included in the price, of course; only if it were to be mine, I should have the heavy dark polished ebonized frame as the picture is sunny (springtime) and the effect would be bully.*

In general, we may say that taste functioned on a low level, the period's "sensibility to the different degrees and kinds of excellence in the works of Art or Nature"—as Hazlitt wrote—being undeveloped and indiscriminate.

Esthetic Considerations

Alternatives for the Artist. In the United States after the Civil War, the artist had the alternatives of conforming and surviving or of making an upstream fight against prevailing standards, but at a price. Lack of support for American art made the latter course unattractive. The late Charles C. Curran N.A., Cragsmoor neighbor and friend of Henry, recalled to the writer (McCausland '41,

p. 149) that when he came to New York in 1881 as a student, there were few galleries and none gave assistance to American artists. The first gallery devoted exclusively to the exhibition and sale of work by Americans was founded only half a century ago (in 1892) by the late William Macbeth. Yet American painting and sculpture had had more than a century and a half of continuous production (Museum of Modern Art '32), not counting the fine anonymous portrait of Margaret Gibbs, painted in 1670. The general lack of support for American artists is witnessed by a newspaper clipping in the Henry Collection (CL. April 3, 1879) which urged that

> *. . . it would be well for American art if such collectors of art as John Taylor Johnson, William H. Vanderbilt, Judge Hilton, Mr James H. Stebbins, Mrs A. T. Stewart, August Belmont and others that we could name, would buy more of it than they do, and they would, too, by so doing, possess much more interesting galleries than they now do.*

The letter to Henry from Frank T. Robinson (CORR. July 25, 1895) quoted above (p. 66) proposed as a remedy that the Nation build a National Gallery of American Art and "that a minister of art for our cabinet" be created, nominating for the office Henry G. Marquand, Metropolitan Museum of Art president. A half century has not seen this proposal effectuated, though government programs for the support of art are an important step forward. Neglect of American art is stressed in the report of W. W. Story, one of the American commissioners for the Paris Exposition of 1878, in which Henry was represented by *Off for the Races* (CAT. 124; FIG. 122). Commissioner Story (Story '80, p. 3, 6, 7, 9) stated that the fine arts are an organic part of our educational system, writing in part as follows:

> *. . . the small sum of $150,000 actually appropriated to cover all expenses of every kind was not only so insufficient in itself, but was so tardily given as to render it impossible for America to make an exhibition worthy of a great country . . . .*
>
> *The consequence has been an injury, not only to the reputation of the country, but even more to its material interests . . . .*
>
> *We wish to take among nations the high place to which we are justly entitled, but we grudge the necessary outlay. Our penurious grants of money for great public objects retards the development of the country.*

Commissioner Story went on to list existing museums and academies in Boston, New York, Philadelphia and Washington, but added that these were supported by private gift, while he sought to have established the principle that the support of the arts is as much a public duty as the support of the sciences. He continued:

> *But these are private and local in their character and funds. They are not national institutions.*
>
> *We have no national collections; no national museums, academies, or schools of art . . . .*
>
> *As a nation, we do not profess to look down upon art; at least we utterly neglect it. It forms no portion of our education, and in the public representative bodies of our country a lamentable ignorance prevails. There is neither knowledge nor good taste in the patronage of the government . . . .*
>
> *If we are a great country, as we justly claim to be, let us behave like a great country . . . .*
>
> *As it is, art is heavily handicapped in America. The notion of our government is that it* [art] *must manage for itself, without means and opportunities of study and culture, depend for its support upon private patronage solely, and develop itself as it may in the cold shadow of neglect. One might as well as expect the highest literary culture without libraries and schools.*

In such a situation, artists obviously had to function at the level of private patronage. Criterions were not high, and the effect was to sentimentalize, degrade and otherwise corrupt American art. Probably most post-Civil War American artists accepted the conditions without protest or rebellion, as Baur has pointed out in regard to Worthington Whittredge (p. 82). No evidence has come to light that Henry rebelled against prevailing criterions.

Patronage and the Artist. Henry's patrons have been listed in part in the Biographical Sketch (p. 30 *f.*). Complete data, as far as are known, are given in the catalog entries. Besides T. H. Havemeyer, William Astor, W. H. Vanderbilt, J. W. Drexel, E. T. Stotesbury, Sam Chew, Richard Hoe, John Taylor Johnson, Charles Peterson, T. A. Vyse, H. C. Dallett and others, the Henry Album Index (Henry 1864–68) lists the following: Mrs Mark Hopkins, John H. Hall, Emil Heineman, George Kemp, Harvey Kennedy, Leo I. Seney, William O'Brien, W. J. Raynor, John Sherwood, G. W. Stow. Their general scale of life may be judged from visual documents such as FIGS. 35–40. It is not an unfair assumption that in the main they mirrored the standards and taste above described. Henry seems to have accepted without question the support available. There is no testimony that he objected to the commission offered by the Minneapolis Henry (p. 58) or even to the shrewish letter of Mrs Moore (p. 31). Like his generation, he went with the stream.

The generalization may be particularized by describing the esthetic school to which Henry subscribed. Meissonier, not Manet, was his hero. Mrs Henry wrote in her Memorial Sketch (p.340):

> ***He was very liberal, however, in his likes and dislikes of others who painted in a different school; and I have often seen him standing before a painting***

of Manet and finding many things in it to admire. Only it must have some originality in it, for he had no patience with copyists.

But, so that there may be no mistake, she adds:

Meissonier always stood to Mr. Henry as the greatest artist of his time.

Henry's time, it may be noted, was the time of Corot and Courbet, the Impressionists including Monet, Manet, Degas and Renoir, not to add Cézanne, Gauguin, Seurat and van Gogh.

Henry emulated Meissonier well, witness the judgment of the National Academy of Design memorial quoted in the Biographical Sketch (p. 66), which states "Surely he may be called the Meissonier of America." Henry had won the designation before his death, *vide* the Cleveland poem quoted above (p. 105). A newspaper clipping pasted at the end of Mrs Henry's manuscript repeats:

Mr Henry never failed to tell a story with his pigments and to tell it as well as any one who painted in the same style. It was the style of Meissonier and Knaus, and with them he was one of the great masters of the style into which he never failed to put something that was his own.

Remaining true to his ideal, Henry stood apart from the battle of Impressionism. He continued to paint "with the Meissonierlike technique, though his old friend J. G. Brown has been influenced by the modern ideas caught in the currents of Impressionism"—says an unidentified newspaper clipping (CL. '04 ?).

From such witness, as well as the internal evidence of his work, it would seem that Henry set himself a lesser rather than a greater objective. If it is argued that he followed the current of his time, nevertheless another criterion existed at that time, as may be read in what Commissioner Story wrote (Story '80, p. 18 *seq.*) of the Meissoniers exhibited in the French section of the 1878 Paris Exposition:

He is an admirable draughtsman. His works are finished with exceeding elaboration and pains. His attitudes and movements are correct, his minuteness of finish and study of detail are surprising, his precision of touch admirable, but all his works bear the mark of over-study and effort. There is a want of freedom and happiness in it all. It is very well done, but it leaves us cold. It is monotonous in tone, rigid and hard in feeling, and not agreeable in color. His figures are as hard as tin. His dresses have no texture or quality, his landscapes and skies no air. Everything has a look of pre-determination and not of accident. It is what it is, because the artist has chosen to have it so, and not because it happened to be so. Nothing is like the real thing, though it is wonderfully copied in all its details. The charm of a work that is finished more through happiness than pains is entirely lost—one feels the labor.

Is not this opinion curiously up-to-date?

The Visual Sentimental Image. The phrase "the visual sentimental image" is used here to describe a typical post-Civil War style when the demand for "family virtues" (p.103) led artists to "prettify" their work. The writer has the impression that the phrase is not original; however, so far search of reference works and consultation with authorities has failed to locate a source. Scholars consulted agree that as a description the phrase is exact.

In the post-Civil War period, American painting founded itself on literal representation of visual subject matter—an expression which some critics today dismiss summarily as "representational" or "naturalistic." It was not an esthetic statement concerned with formal and plastic research, as were Impressionism, Post-Impressionism and Cubism. The picture was made, not to be seen for pure theoretical motives, but to tell a story in pictorial terms. Further, the emotional intensity of the expression was at best moderate; for the powerful dynamics of romanticism, as in Géricault or Delacroix, middle class art of the time substituted ardors of the parlor, for example, *Library of Jonathan Thorne* (CAT. 72; FIG. 39) and *Parlor on Brooklyn Heights* (CAT. 98; FIG. 40). Sentiment was the emotional channel for the genteel. In the United States the visual sentimental image reached its apogee in the rosy-cheeked smiling newsboys of J. G. Brown, scrubbed behind the ears. The sentiments represented in visual terms in the main did not strike deep chords of human experience. By comparison with the figure paintings of Corot, the portraits of Degas and Manet, the superb formal statements of Gauguin and Seurat, the realism of Courbet and the monumental creations of Cézanne; this typical expression is a dilution. Measured, also, by our own masters, Ryder, Homer and Eakins, the visual sentimental image is a minor expression.

Not all of Henry's work can be so described; and it is likely that in a kinder climate he would have escaped the "genteelizing" process. His development in style and choice of subject matter graphs the decline of American genre painting which Goodrich has pointed out (Whitney Museum of American Art '35). Henry's emphasis has been described (CL. '04 ?) as follows: "He calmly continues to paint those delicate studies of a vanished epoch," the "evocation of sweet, brave, old fashioned days." In 1906 the Art News (Anon. '06) referred to the "quaintness of custom and costume" in Henry's paintings. The *laudator temporis acti* motif in itself gages the quality of the time: the tendency to admire the past and to reject the present, which may be called cultural

recidivism, is typical of an esthetic which will not face existing reality. To such a point of view, the past offers a retreat as safe as the opposite tendency to retreat into experimentation and formalism. Yet while Henry and his generation were extolling the glories of time past, the young "New York Realists" (Whitney Museum of American Art '37) were going out into the city streets and portraying the facing of living humanity with zest and tenderness. The Will Low criticism referred to before (p. 65, 104) may be quoted, in part, again:

> *There are few American artists who have better served their country in preserving for the future the quaint and provincial aspects of a life which has all but disappeared.*

Does the statement imply that this life was of importance not by virtue of what it was or what it meant, but simply because it has *disappeared?* If so, an esthetic *status quo* is set up, as if what *was,* is venerable and deserving of the artist's brush, and what *is,* is of no account. In a clipping from the Ellenville Journal of February 14, 1918, pasted on the back of page 63 in Mrs Henry's manuscript, which quotes from a New York newspaper criticism of the painting *St Mark's in the Bowery* (CAT. 215; FIG. 381), the adjective *old* is used five times in eight sentences.

"Family virtues" were in demand, Goodrich wrote (p. 103). In choice of subject, this factor operated to produce such paintings as *The Widower* (CAT. 106; FIG. 117), *A Quiet Corner by the Door* (CAT. 107; FIG. 118), *The Old Paternal Home* (CAT. 110; FIG. 119), *Sunshine and Shadow* (CAT. 116), and *Out in the Storm* (CAT. 376; FIG. 199), which may be referred in the reproductions in this report. Other examples of the visual sentimental image in Henry's work are: *The Old Clock on the Stairs* (CAT. 70; see FIG. 214), *The Invalid* (CAT. 71), [*"A Cold Deceitful Thing Is The Snow"*] (CAT. 73), accompanied by a poem (Henry 1864–68, p. 30; see p. 160), apparently of Henry's own composition, [*Old Woman Reading*] (CAT. 81), *An Unexpected Attack* (CAT. 94), [*The Snowstorm*] (CAT. 95), [*Nurse and Two Children*] (CAT. 101), *The Young Heir* (CAT. 103), *Taking a Nightcap* (CAT. 112) and [*Children in a Graveyard*] (CAT. 121), photographs of which may be consulted in the Henry Album.

Effects on Henry's Work. Henry's working life, as said before, outspanned the *Salon des Refusés* and the deaths of Cézanne and Renoir. From 1859 to 1919, painting in the western world underwent drastic changes. In the United States, genre declined—

perhaps America's most characteristic expression, folk art excepted; and the theories of Impressionism and Post-Impressionism were tardily accepted by Weir, Twachtman, Hassam, Prendergast and others. Yet, according to a clipping at the end of Mrs Henry's manuscript,

> *The technical style of E. L. Henry underwent no changes or evolution in the full fifty years of his professional career.*

Is this true?

In the main, Henry's style and choice of subject matter typifies the development of painting in the United States after the Civil War. The golden day of genre culminated in Mount, Bingham and Johnson. Thereafter, other values controlled painting. In Henry's case, the early *Barnyard Scene* (CAT. 12; FIG. 92) and *Farm Scene in Pennsylvania* (CAT. 13; FIG. 93), both painted in 1860, stylistically may be called the last glow of the golden day. In these canvases, his style is relatively free and warm, not yet frozen into his later hard, tight *Meissonierlike technique* (p. 67). Years of study in Europe and the Civil War intervened, and Henry began to be subjected to the academy, to the European vogue and to the new patronage. In *The 9.45 A.M. Accommodation* (CAT. 65; FIG. 109), painted in 1867, he still derives, however, from the American genre tradition, depicting realistically an event of everyday life and at the same time expressing it with enthusiasm and verve. A dozen years later Henry was continuing to paint American railroad stations with crowds waiting for the oncoming train; but by this time the subject has ceased to be a spur for his imagination. In this interval there was a tightening of line and a graying of color, evident but not crucially distracting in *City Point, Va.* (CAT. 96; FIG. 107), painted in 1865–72, in which Henry reached his goal of emulating Meissonier. One of the best Henry's, if not his masterpiece, this canvas has the authentic virtue of its fidelity to nature. Though it does not appeal on plastic or sensuous grounds and though its color is subdued and certainly less exciting than Blythe's *General Doubleday Crossing the Potomac* or Bierstadt's *The Bombardment of Fort Sumter* (Metropolitan Museum of Art '39, PL. 192, 184), to take comparable instances, nevertheless *City Point* has the harmony of its own design and the integrity of its own method. Tight gray waves of the Appomattox are organized in a composition conscientiously observed and executed by the painter, with copies natural detail (Fig. 107).

Hereafter, Henry's style evolved along the period's typical path. He painted realistically, representationally or naturalistically—

whichever word is preferred—reproducing physical visual detail almost as minutely as in photography, with colors subdued, though not as dark as the bitumen which Düsseldorf foisted on American painters from Duveneck to Luks. In his Cragsmoor genre themes, beginning about 1880, Henry achieved a warmer palette. His historical reconstructions are not as strong in color as his genre paintings and have been described by present-day critics as "candy-box covers." According to his posthumous biographer, Mrs Henry, Henry remained untouched by Impressionism. But is this completely accurate? Brushwork may be noted in *A Virginia Wedding* (CAT. 231; FIG. 155), painted in 1890, which is somewhat akin to Impressionist divisionism. Does Henry's note on *The Four Seasons* (CAT. 372, 1–4; FIGS. 204–7) "Each in its season at the same place" (p.226) echo Monet's procedure in painting haystacks, Waterloo Bridge and Rouen Cathedral? Toward the end, Henry's painting relaxed its characteristic hard outline, which may be construed as, if not an actual concession to, at least an unconscious response to the influence of Impressionism.

This possibility may be supported by an episode related by the late Jerome Myers in his Artist in Manhattan (Myers '40, p. 37):

> *It was at the Armory Show that I was introduced by friends to E. L. Henry, who was then in his eighties.* [E. L. Henry, having been born in 1841, would have been 72 in 1913. E.McC.] *I had known his work, for which I had a great respect. Together we went around the huge show. Henry had an impairment of one eye, to such an extent that he had to hold the eyelid up with his finger to see. Yet he carefully looked at all the pictures, and when he had finished, he said, "Mr. Myers, they told me there was a lot of crazy wild art, here, but I really found it wonderfully interesting and I am very glad to have seen it." This was the unbiased tribute of an unpretentious American of a past generation.*

The critic Forbes Watson adds his personal recollection that Henry was urged to exhibit in the Armory Show but refused.

The period's influence on Henry's painting may be observed particularly in his selection of and treatment of subject matter. The typical idealization of style had a parallel in the painter's attitude toward his material. Just as the J. G. Brown scrubbed newsboys purported to be "real life" but were not, so Henry's painting purported to be an exact realistic transcript of nature. Actually it was not, as he altered literal visual fact in many instances. Yet today his paintings appeal chiefly on the basis of historical value—their mirroring of American life in that time, their humor and especially their recording of the history of 19th

century transportation in the United States. About the accuracy of his paintings of historical events, skepticism is permissible, in view of the fact that they are mostly reconstructions. Skepticism may also be allowed in regard to his genre subjects, because he systematically altered details.

In regard to humor, changing times evolve changing standards, and much that seemed funny in Henry's time does not seem funny today. Again, the need for revaluation is evident. The subjects described in the section on humor (p. 92) undoubtedly had a vogue; they appeal to that superiority inherent in the phrase "country jake." To a degree, they recall aspects of American life not far removed in time from the present. The most informed taste, however, probably rejects the humor exemplified. Today it does not seem funny that white children "picked on" a Negro girl, upset her bucket of huckleberries and ran away in gales of mirth. In general, the standard of humor of the second half of the 19th century is well summed up when Henry uses Negro subjects. In his paintings, the Negro almost always appears as a servant or a social inferior, that is, a shabbily dressed, unkempt farmer or loafer at the village crossroads. In this attitude, Henry simply reflected his period. Eastman Johnson also echoed the prevailing white superiority in some of his paintings on Negro themes (Baur '40, PL. 16); and even Winslow Homer's *A Happy Family in Virginia* (Whitney Museum of American Art '37, p. 21, no. 12) might be so construed. The conception of the "pickaninny" as a comic figure to be laughed at on the minstrel show stage was typical of the time.

Why did Henry alter visual detail? The point is not of prime importance; for an artist is surely free to rearrange nature as he pleases, and when optical or emotional rather than so-called "real" appearances are recreated, the liberty is valid. Henry has been praised, however, especially for his "meticulous documentation" (p. 64, 95). Plainly standards of documentary fidelity vary from period to period; for there are many instances in which Henry changed details without a corresponding esthetic gain. For example, *Sunday Morning* (CAT. 283; FIG. 67) recreates a Sunday morning scene in front of the old Dutch church at Bruynswick, Ulster county. This 200-year-old edifice, known as "Shongum Church," is a fine example of the region's colonial architecture. Henry naturally has to reconstruct the churchgoers in colonial costume. He had the church at first hand to study, for visual accuracy. Yet he eliminated one of its five columns (FIG. 68), saying that a

church could have only four. Myth is strong: today the caretaker tells visitors (McCausland '41, 30) that the fifth column was added after the picture was painted—this despite Miss Woodward's evidence (p. 202 *ff.*). Was Henry influenced in his standard of ideal church architecture by the fine church at Napanoch (FIG. 70; see McCausland '41, p. 40), almost next door to the Vernooy Place (p. 46 *f.*), which attracted him as an architectural specimen?

The example is not isolated. Consider the painting [*Maud Powell Plays the Violin*] (CAT. 319; FIG. 71). Major John W. Powell and his family, including his violinist daughter, summered in Ellenville in the 80's, and Maud Powell hired an empty Canal Street house to practise in. So much for the story Henry tells. When he painted the picture, however, he altered the material of which the house was built. Ellenville never had *stone* houses, according to Florence T. Taylor, Ellenville librarian (McCausland '41, p. 220). The Canal Street house formerly occupied by the Otis family, whom the Powells visited, is a good example of wooden frame Victorian Gothic, in 1941 painted white. The point is not crucial, except that a future researcher trusting to the apparent visual accuracy of Henry's details could be led astray as to Ellenville architecture, if he had no other source of information. It would be a little hard to argue, on the esthetic side, that the painting gains anything by making the house of stone.

Bear Hill (CAT. 347; FIG. 79) was assembled from diverse elements, according to the specifications of its owner, Martin E. Albert, who commissioned the painting (p. 220). A further example of this habit of Henry's is *An October Day* (CAT. 308; FIG. 202), which may be compared with the Cragsmoor post office (FIG. 201) as it looked during my field trip in 1941. Henry's painting shows the rooftree at right angles to the position shown in the 1941 photograph. Has the building been rebuilt since Henry painted the canvas in 1903? Apparently not; an old photograph in the Henry Collection shows the rooftree at right angles to the front porch. Therefore Henry simply revised the building to suit his own taste. In so doing, he lessened to a degree the painting's historical value; for the building is no longer literally accurate and thus can not be accepted as typical of Cragsmoor architecture 40 years ago.

Another instance is *Village Post Office* (CAT. 248; FIG. 62), known to me only through a faded and crumpled photograph in the Henry Collection. The painting seems to be a good one,

related in quality to *The Country Store* (CAT. 181; FIG. 127), and certainly less hard in line and brushwork than many of Henry's canvases. *Village Post Office* shows the old Jesse Low store (FIG. 63) at the corner of Canal street and Cape road in Ellenville (McCausland '41, p. 109), still standing little changed in 1941. The painting is not a literal visual transcript of nature, however. In the first place, the Low store never was the post office, according to Mrs Taylor (McCausland '41, p. 109); the church is correctly placed, but the houses are not; and so on. Similarly Sidney Terwilliger of Cragsmoor recalls (McCausland '41, p. 172) that Henry "wouldn't do us children as we were. He'd have us take off our shoes and stockings and put our shoes back on without stockings." In *Spring* (CAT. 315) Henry changed the position of the road in relation to the Coddington cottage—formerly the George Mance place. Mr Terwilliger found an old photograph of the cottage to show how in the painting it had been turned at a right angle to the road (McCausland '41, p. 171, 189).

Henry's Importance for Today

Contemporary Consensus. In his own time, Henry's rank as an artist was secure, as the self-appointed historian of the manners and customs of earlier days, as Isham wrote (Isham '27, p. 346–47):

> *No one else knows so well as he the manners and customs of an age which has become old-fashioned, but hardly as yet historic; the first half of the last century, when travel was by way of stagecoach or pack boats on the canal, when railroads were strange innovations of doubtful merit, when women wore hoops and carried reticules and bandboxes and the men were stately in swallow-tailed coats and hats of real beaver fur.*

Similar quotations throughout this chapter and in the Biographical Sketch indicate the place Henry won during his lifetime; and more are set down here. The historical usefulness of his paintings was the point stressed by contemporary critics. "He is really the art historian of early American life and customs," wrote the Art News in 1906 (Anon. '06). In 1919 Will Low (Low '19) emphasized the service Henry had performed "in preserving for the future the quaint and provincial aspects of a life which has all but disappeared." He continued that Henry's "typical American product . . . devoted to the perpetuation of truly national themes [was] a life work of which an American artist may well be proud."

Pasted at the end of Mrs Henry's manuscript is a clipping headed *Pictures as History*, which reads in part:

> *. . . a phase of pictorial art too little understood or appreciated . . . pictures as historical records. . . . As an American social historian, Henry may have failed of recognition in his lifetime . . . . But there can be no doubt of the value of his pictures to the social student of future years. Now that St John's Church in Varick Street is gone forever, Henry's charming picture of it* [see CAT. 79, 324, 325; FIGS. 112, 247, 248] *preserves a social and architectural record that American art could ill spare.*

Henry's admirers, however, were not unaware of adverse judgments on his painting, as may be noted in the American Art News (Anon. '19) obituary:

> *Some critics have considered Henry more as an illustrator than as a painter, as he deals with minute details and carefully finishes his canvases to the end, like his early fellows of the old Hudson River School—but this estimate is hardly a fair one.*

Another clipping pasted at the end of Mrs Henry's manuscript may be quoted:

> *The tendency of the day is to slight the fact that every true picture tells a story. The apostles of "art for art's sake" are in the ascendency. They try to relegate the story-telling picture to the realm of illustration.*

As early as 1876, Professor Robert W. Weir wrote in his official report on the 1876 American Centennial Exhibition (U.S. Centennial Commission '76):

> *Mr Henry's style is often ragged and unskillful, but his aim is a compensation, and he attains happily the sentiment of olden times.*

Thus the dwindling popularity which overtook Henry toward the end of his life was the fate of a style rather than of a person. The process may be observed with many 19th century American artists, who went into eclipse and are but now emerging. At Henry's death it was stated, in a clipping pasted at the end of Mrs Henry's manuscript, that "His pictures today are miles out of fashion in manner and subject," this despite the fact that

> *In his own metier, Mr Henry had no superior. His simple, homespun genre paintings, too full of precision and detail to suit the tastes of the moment* [1919] *are the best of their kind.*

A little later—according to letters in the Henry Collection, dated 1925 and 1931—New York art dealers informed Mrs Henry and, after her death, her heirs that there was no market for Henry's work, his style being out of vogue. Moreover, Mrs Henry could

not place the manuscript of her Memorial Sketch, due probably not only to its commercial unavailability but also to the lack of audience for Henry's kind of painting.

Revival of Reputation. Today, a quarter of a century after his death, Henry is coming back into fashion, on a wave of American genre. The exhibition of his work at the Century Association in New York in May 1942 (Century Association '42) is an indication that painting of this kind is returning to favor. Royal Cortissoz's review in the April 26, 1942, issue of The New York Herald Tribune, headed "Edward L. Henry and Some Others," suggests how gladly the return is welcomed in quarters which always kept a soft spot for the old school. The review reads in part:

> *A particularly welcome development in the domain of exhibitions has been the growing revival of interest in certain of our older men. I do not forget the large historical exhibitions, in which they would be bound to appear, but what I especially have in mind is the one-man show. The Brooklyn Museum has played a conspicuous part in this movement, paying tribute to Eastman Johnson (whose brilliantly painted "Husking Bee" would alone justify renewed attention to him), to John Quidor and W. S. Mount. The first named of these has been well recalled, also, very recently at the John Levy Gallery. The Babcock Gallery has done honor to Winslow Homer and to Ralph Blakelock. And I might cite signs of an awakening to the fact that our seniors have a right to remembrance, even though they did not paint like, say, Manet. Another one of them is just now being commemorated at the Century Club. He is Edward Lamson Henry, who was born in Charleston, S. C., in 1841, and died in New York, in 1919.* [E. L. Henry died in Ellenville. E. McC.] *He was a member of the National Academy of Design, to which he was elected as a painter of genre, drawing his subjects from American life. His work has been unjustly neglected. It is that of a good craftsman who treated his simple material with a markedly sympathetic touch. The present exhibition is one of the most charming of the season.*

Cortissoz continues his tribute by describing Henry's subject matter as "Pictures of People" in a subhead:

> *It is charming because it contains exact pictures of our people, mostly in homespun, so to say, the people of what is called today the horse-and-buggy era. . . . The manner in which he was prepared to deal with his material is rather surprising to learn. His earliest training was received at the Pennsylvania Academy, but he was only nineteen when we find him a pupil of Charles Gleyre in Paris. What is surprising about the conjunction of his name with Henry's is that he was a painter of religious and mythological pictures, the last things in the world that the young American might have been expected to emulate. In fact, he did nothing of the sort, but, on the contrary, followed his own path, and though he subsequently visited Europe more than once, especially Paris, Rome and Florence,* [not to mention England. E. McC.] *he turned irresistibly to the stuff of the*

American scene, for his themes. In his twenties he found some of these in the Civil War. One of the pictures at the Century is a large, panoramic view of "City Point, Virginia, Headquarters of General Grant." It is a workmanlike affair, but not in his real characteristic vein. That is illustrated far more conclusively in the exhibition in the "Street Scene in Naples," done in 1864, and the better for being shadowy instead of registering the flood of sunlight conventionally associated with such studies. But it was at home that he did the work he was born to do.

He made his choice thoughtfully. The face that looks out at us from the portrait—admirably painted—of J. G. Brown, is eloquent of intelligence. The choice was directed, however, chiefly by instinct, by a deep inner feeling for American life. Despite his so different preoccupations, Gleyre had disciplined him in the fundamentals of his craft. Henry could draw. He had a sound sense of composition and a modest but excellent gamut of color. Also, as is shown again and again in this exhibition, he had a gift for the landscape background. Above all, he caught with its true sentiment the note of his selected field. Nothing could be more veracious than or more agreeable than the roadside episode entitled "News of the Nomination," in which the occupant of an old wheeled vehicle pauses to give his tidings to a pair of farmhands. It is a reconstruction, as it were, for it dates from as recently as 1896, but it remains absolutely spontaneous and convincing. I would note here, too, the merit in the landscape. Henry never fails to lend that factor the charm of which I have spoken. It is a fine part of the pictorial unity which he was wont to achieve. For he always saw his picture as a whole, not only the figures but their surroundings, welding them all together in a closely knit design. He could manage this even when he took a rather sprawling subject, as in the railway scene, "The 9.45 A.M. Accommodation." He put much into this composition but leaves it well balanced. Henry was a competent painter.

He was also varied. Sometimes he would do a "costume piece," as in the "Passing of the Outposts," or "The MacNett Tavern," or the festal "Virginia Wedding." More often he clung to later habiliments and painted pictures like the "Sharpening the Saw" or like the delectable one of "The Latest Village Scandal," in which country types stop their horses and exchange gossip. Somehow one can't help feeling that there is a kind of innocence about the "scandal." [Particularly as there is no evidence that the title is Henry's own. E. McC.] *That is the ultimate impression that Henry leaves, one of the sweet sentiment, the neighborliness, the friendly domesticity, to which he was essentially dedicated. His pictures are as wholesome as bread and butter, and it is good to have them brought back into view. For they are, in the bargain, well painted.*

Pros and Cons. Despite errors of fact—such as that Henry was elected to the Academy as a painter of American genre subjects; his presentation painting was an Italian street scene—the Cortissoz opinion reflects the most favorable judgment criticism today is likely to make on Henry's work. At the opposite extreme is the opinion of Neuhaus (Neuhaus '31, p. 145):

His pictures have little artistic merit, but today they are of interest as replicas of the customs and costumes of our ante-railroad days.

The most sensible present-day judgment lies between these two poles, the one uncritically embracing the academic and the other totally rejecting it. Felicitous and pertinent is an excellent middle-of-the-road statement from the late Charles C. Curran, N.A., the old friend and neighbor of Henry often referred to before (p. 106 *ff*., 254). In a personal letter to the Director, Dr C. C. Adams, dated August 1, 1942, he wrote, in part, as follows:

> *Critically I think he* [Henry] *could be said to be about sixty per cent historic and forty per cent pictorial. When it comes to the question of pure artistic quality, I should not rate him very high. Artistic quality was, I think, second in his mind, the human subject first. I know he greatly admired the work of artists who are placed high in the scale of greatness. Henry's place in the annals of the past will, I think, be largely as a recorder of the ways and manners of his and of previous times.*
>
> *He drew sufficiently correctly; but he will not be classed as a great draftsman. His color was accurate; but mere accuracy in coloration does not constitute a painter as a "colorist." His compositions were good regulation plans; but he could not be called a great designer such as artists like Thayer, Inness, Brush, Wyant, Dewing and their like.*
>
> *It would be as much of a disservice to Henry's memory to rate him too high as to rate him too low. I think Henry would agree to this.*

Conclusion. By the above evidence, Henry was highly regarded in his own time as a pictorial historian of the American scene, his paintings being considered source books for students of the past. In the past quarter of a century, his reputation has waned and been rehabilitated. But current interest in his work derives from different motives than in his lifetime; in the past three quarters of a century, taste and critical opinion have traveled a considerable distance from the taste and criterions of his age. Today the more prevalent opinion is that Henry's genre paintings are his best work, because they are more representative of life in America in the late 19th century and because they are more esthetically expressive than his historical set pieces.

There is no need to evaluate Henry's painting by a documentary standard, even though his contemporaries thought they did so. In the sense of the past decade, *documentary* is a discipline of realism based on scientific observation and statement. In the inescapable truthfulness of such documents as photographs of real life, the modern soul finds a counterpart for modern technics. This is an esthetic in its essence almost antiseptic, certainly hygienic (Abbott '41, p. 163–69). As George Bernard Shaw wrote in 1910 (McCausland '42):

> *Photography is so truthful—its subjects such obvious realities and not idle fancies—that dignity is imposed on it as effectively as it is on a church congregation.*

The discipline, as a matter of fact, operates in all great realistic art. Of Caravaggio's *Boy Bitten by a Lizard* or Bernini's *Portrait of Costanza Buonarelli* (Museum of Modern Art '40, p. 52, 58), one feels that this thing happened, this person was; the esthetic impact is immediate and real. The esthetic of Henry's period, however, was not of such a character. Sentiment rather than realism ruled. If his method was one of "meticulous documentation" (p. 64, p. 95, p. 114), it was the meticulous documentation of details, not of essences. Delacroix in 1839 might paint *The Battle of Taillebourg*, which took place in 1242, or in 1831 paint *Boissy d' Anglas at the National Convention in 1795*, and, because profound human, historical and esthetic awareness informed him, make a significant and moving statement of historical themes. But the so-called historical paintings of Henry's generation were for the most part set pieces, mannequins posed and draped, properties in place. Henry's period accepted such reconstructions as historical, though by the standards of the second third of the 20th century they are not.

Henry's genre work, however, deservedly earns him the title of pictorial historian. Working from life, rather than from prints, costumes, vehicles and the like, he studied people, houses, landscape, clothing and accessories of the Cragsmoor scene, to give these back in his own dry, unemotional style. Lacking great warmth of feeling or plasticity of form, his paintings of everyday subjects nevertheless are expressive and even evocative. If the present-day beholder has no personal memory of the subjects represented, he may still obtain a fair knowledge from these paintings of the time's visual aspect. If the subject matter is familiar, the paintings arouse overtones of remembrance, of what was known and is remembered pleasurably. The current vogue for Americana must to a large degree be rooted in such understandable psychological factors; to the genuine rediscovery of the recent American past, sentimental motives have been added to the valid cultural objectives.

It has been stated above (p. 114 *ff.*) that in his paintings of genre subjects Henry mixed hybrid elements, borrowing a detail here and a detail there, and mingling costumes and architecture from different periods. With this caution in mind, it is possible to derive a quantity of information from his work. His paintings are especially informative in regard to details. The interior of *Sharpening the Saw* (CAT. 195; FIG. 136) appears to have been carefully observed. Scenes of farm and country life seem accurate, even when the visual facts have not been verified minutely. For

example, the buffalo robe of Peter P. Brown, seen in a number of pictures (FIGS. 137, 139, 146), is an interesting bit of factual information. Is Henry's painting then essentially miniature still life? That the frozen image of *nature morte* was congenial to him may be noted from his habit above mentioned (p. 92) of working from plaster casts of horses' legs. His genre paintings record people as well as appurtenances. The six small portraits owned by the village of Ellenville tell a good deal about the men and women portrayed. John Billings (CAT. 167; FIG. 133) is differentiated from "Aunt Nelly" Bloomer (CAT. 230; FIG. 132), whom Henry visited on her hundredth birthday, carrying her a bouquet. "Black Fred" (CAT. 194; FIG. 131) is depicted in worn work clothes, no doubt as he was customarily seen about Ellenville. Henry's exactness of factual representation is attested by the painting (FIG. 128) and the photograph (FIG. 134) of Carpenter "Joe" Mance. In general, this is the kind of information which may be garnered from a study of Henry's painting.

A "typical American product," Will Low (Low '19) called Henry. Is such the respect in which his work is of most value today? In the limitations of his art, is the period faithfully mirrored? In technical matters, this seems true. Henry's painting is meticulous, neat, carefully studied, industriously produced. He was a carefully trained draughtsman and expert in his painting craft, so that today his canvases are well preserved, showing no signs of cracking or undue darkening. He was not a great colorist, as Homer was in water color, nor did he possess a great plastic gift, as Eakins did. He did not show forth the joy of living expressed by Mount. Henry lived and worked in a period perhaps best described by the adjective "circumscribed." The tiny, even haggling quality of his brushstroke may thus be considered indicative not of his individual talent but of the period's character.

Yet this is not the whole picture. The culture of Henry's time has been inherited by Americans today. Despite lacks and evasions, that culture speaks of historic American experience. Though sentimentalization of the Negro in art, as elsewhere, is regrettable, nevertheless the fact that Henry frequently painted Negro subjects shows him reacting to life around him, and in that life the Negro appeared more and more. Though the period tended to vulgarize genre, yet Henry revealed sensibility when he painted Cragsmoor and Ellenville characters. Surely he used such subject matter because it appeared to his imagination? Further, his treatment of country themes is significant. Through the early part of America's

history, the rural community was homogeneous; in Henry's time there began to be a division, evidenced at Cragsmoor by "summer people" and "natives." Even so, the democratic spirit of earlier days was not dead. This may be seen in the best of Henry's country life paintings. So analyzed, his work is indeed best described as typical.

Henry's paintings record a period which is gone. They arouse a nostalgia which Henry doubtless would have approved; and they visualize a time not far removed, re-creating scenes familiar not long ago. Henry's picture of the past spells security in the uncertain, changing today. Perhaps we attribute to that time virtues it never had? At any rate, the pleasure gained from work like Henry's is that it reminds us of the past. Because it does not question or criticize that past, we can endow memory with a glamor probably fictitious but nonetheless pleasurable. Take an example of how memory "glamorizes": Henry is often spoken of as the recorder of "horse-and-buggy" days; and surely he set down, with great attention to detail, the visual image of many kinds of horse-drawn vehicles. Those old enough to remember pre-automobile days are reminded, when they see such pictures, of their youth and savor that remembrance. However, probably none would wish to abandon the motor vehicle and return to the horse and buggy—even in gas rationing days (1943).

The appeal of Henry's painting, then, is that it speaks on a level of experience shared by many. It makes no exorbitant demand on emotion, nor does it force the spectator into fantasy. It deals recognizably with the known. Accepting the familiar as its base, it postulates a common denominator of great scope. Despite lacks and limitations, Henry's painting is another reminder that a popular art in the United States today would best be based on general human experience, stated in intelligible terms. By his implications, perhaps even more than by his absolute esthetic achievements, Henry may be said to be integrated in the native tradition and therefore well to deserve his place in the history of painting in the United States.

More than this should be set down on the importance of artists of Henry's rank for the American tradition. In the accelerating rediscovery of that totality loosely called "America"—the whole complex sum of American history, experience, culture and aspiration—men like Henry are seen to stand higher than formerly they were thought to do. This is due not alone to the impact of world events on the Nation but also to an esthetic process which is now,

as it were, completing its cycle and returning upon itself. I refer, of course, to the return to an interest in and a concern with realism or naturalism as a convention capable of expressing broad democratic meanings.

Those who say that America (meaning the United States) is too young to have a history fail to see that already by the 19th century an American stamp had been thrust deep into the yielding substance of native subject matter. Nevertheless sincerely scientific study of this period, of which Henry is a characteristic product, reveals that a prime object of the painters of the time was that rendering function of art, which has been lost in the furious theoretical battle of 20th century artistic theory. The visual artists of that too often scorned academic age were given at least two arrows for their quiver—sound training in draftsmanship and orientation to the outer world. If they had a philosophic point of view as well is another question. However that may be, having been trained to useful tasks in art, they succeeded in creating a better and more expressive portrait than they knew of the America of their time and place. To this increasingly valuable and significant visual chronicle Henry contributed his full share.

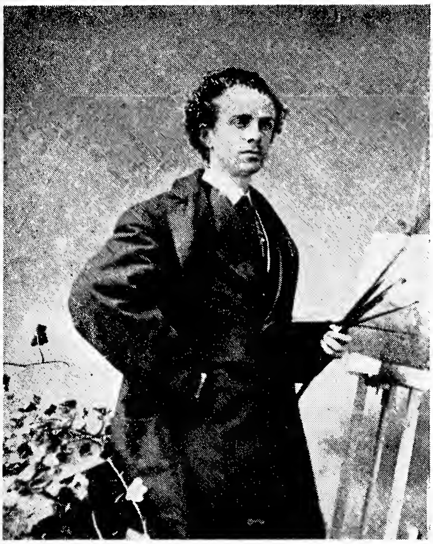


Figure 33 E. L. Henry, *circa* 1867. (Photograph by Sarony, 680 Broadway, New York City)

Figure 34 *From a Window, Newport,* 1866: CAT. 62

Figure 35 "Taken at Mr Jessup's House, Marine Ave., Newport, R. I., Aug. 1866." Henry is third from the left, perched on the rail

Figure 36 "Mrs A. D. Jessup's Rig with Seat Behind for Footman. Used at Newport, 1866"

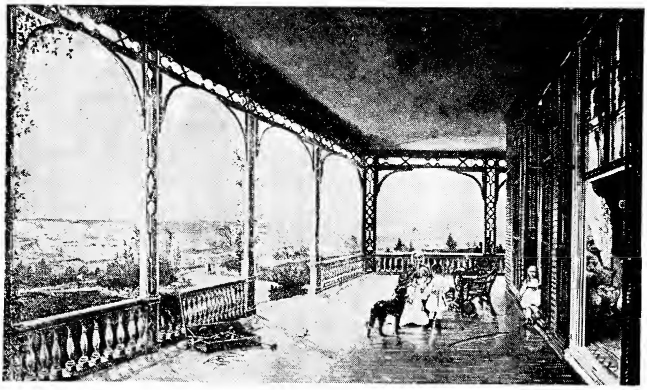


Figure 37 *Porch Scene, Newport, R. I.*, 1866: CAT. 61

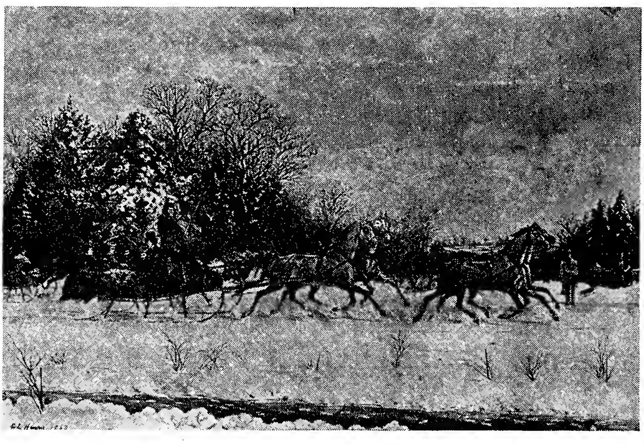


Figure 38 *Four-in-Hand, Central Park*, 1867: CAT. 64

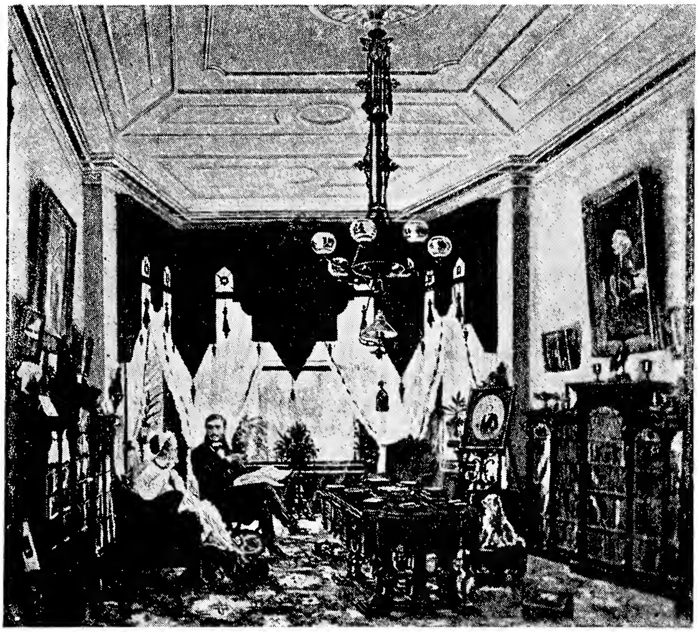


Figure 39 *The Library of Jonathan Thorne, 526 Fifth Avenue, New York,* 1868: CAT. 72. "Just after they were married"

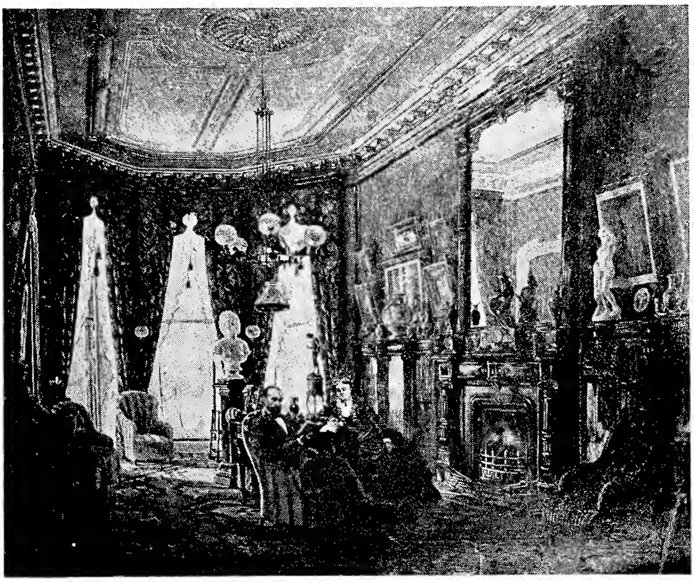


Figure 40 *A Parlor on Brooklyn Heights,* 1872: CAT. 98. This was painted "from Nature" for Mr and Mrs John Bullard

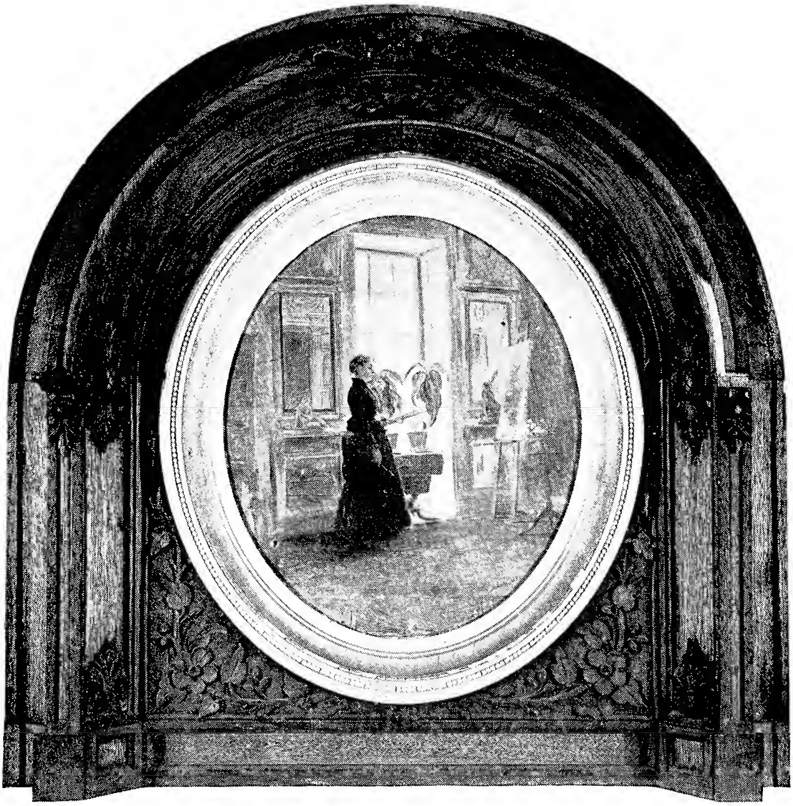


Figure 41 *Portrait of Mrs Henry, London,* 1876: CAT. 122. Note the Victorian frame. Collection, New York State Museum

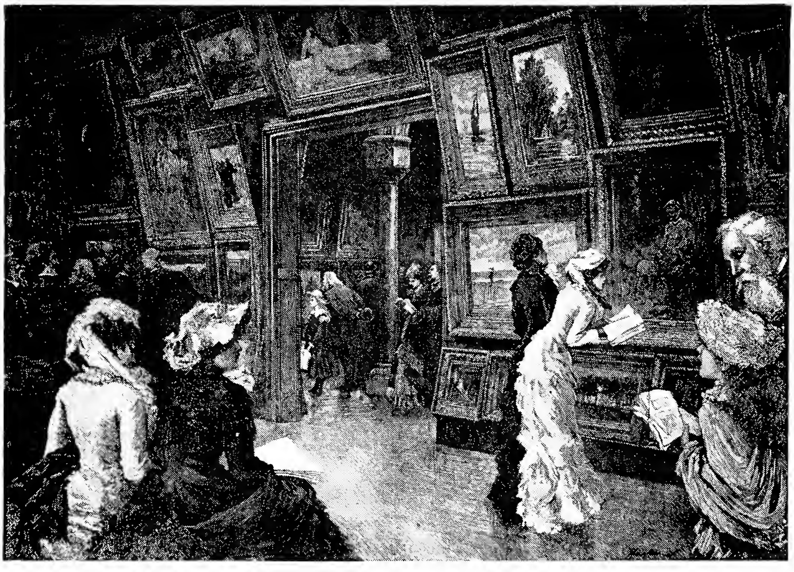


Figure 42 *In the National Academy of Design,* a wood engraving by William St J. Harper, published in Harper's Weekly, April 29, 1882.

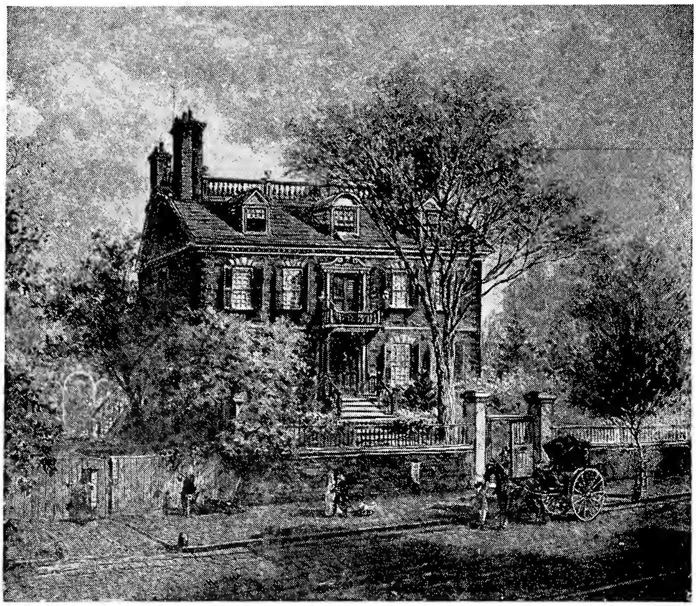


Figure 43 *The John Hancock House,* 1865: CAT. 54. Collection, Estate of Francis P. Garvan.

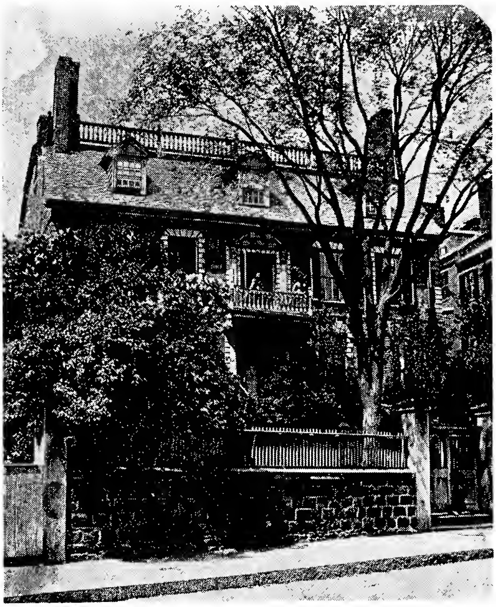


Figure 44 "The Hancock House. Taken down for common modern houses about 1865"

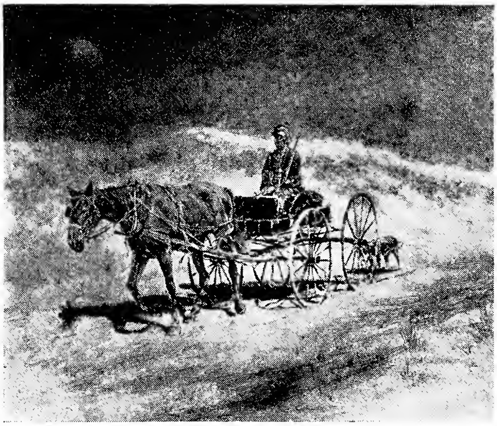


Figure 45 *Beach Wagon:* CAT. 1010. Collection, New York State Museum

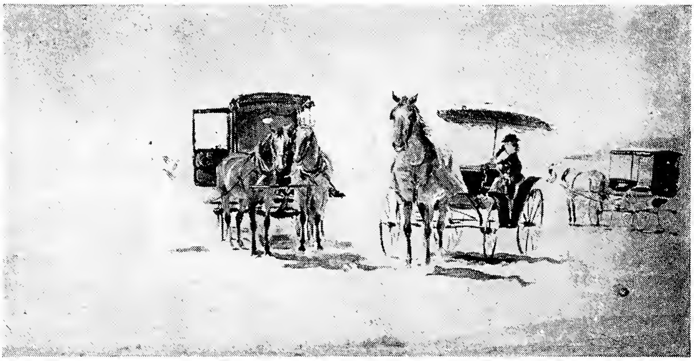


Figure 46 *On the Beach:* CAT. 1068. Collection, New York State Museum

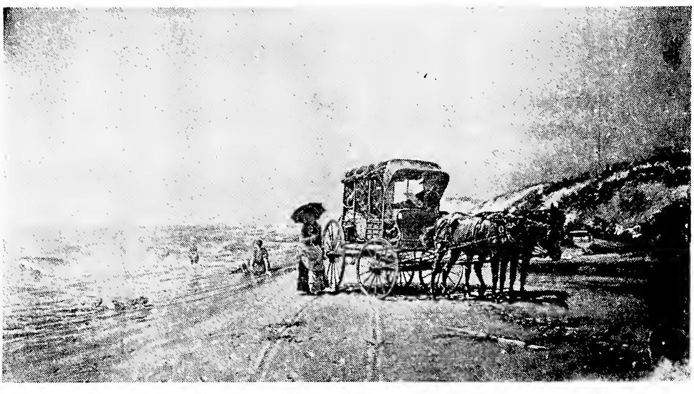


Figure 47. *On the Beach: Waiting for the Bathers:* 1879: CAT. 140

Figure 48 *East Hampton Beach,* 1881, earlier version of figure 49

Figure 49 *East Hampton Beach,* 1881: CAT. 154

Figure 50 *Bathing Hour, East Hampton Beach,* 1889: CAT. 154-*a*

Figure 51 *After David, circa* 1875: CAT. 1001. Collection, New York State Museum

Figure 52 *Taking Life Easy,* 1911: CAT. 359.

Figure 53 A photograph used as a detail for figure 52

Figure 54 *The Mountain Stage,* 1881: CAT. 155

Figure 55 "Stage built 1845 Concord, N. H. Ran from Newburg to Ellenville. Photographed in Otis yard 1881." On the box are Henry, Harriet Otis (?), Mrs Henry and the driver, Dick Elting of the old Elting House in Ellenville. This photograph was used for figure 54

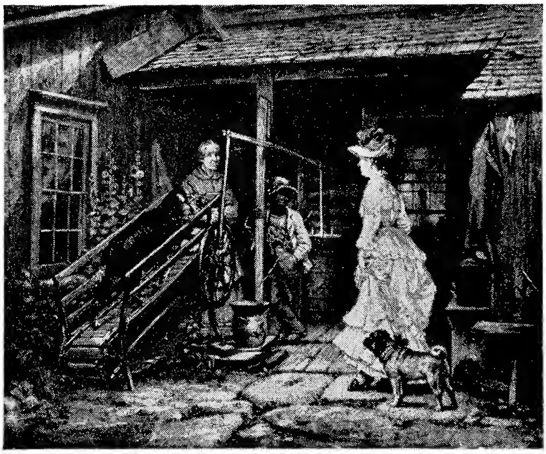


Figure 56 *Capital and Labor,* 1881: CAT. 150. Collection, New York Historical Society.

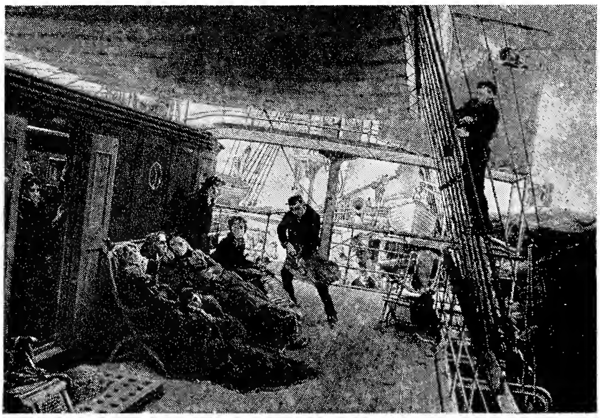


Figure 57 *In the Roaring Forties,* 1884: CAT. 175. Collection, Mrs Seabury C. Mastick.

Figure 58 *The Old Lydig House on the Bronx, Near Fordham,* 1887: CAT. 197

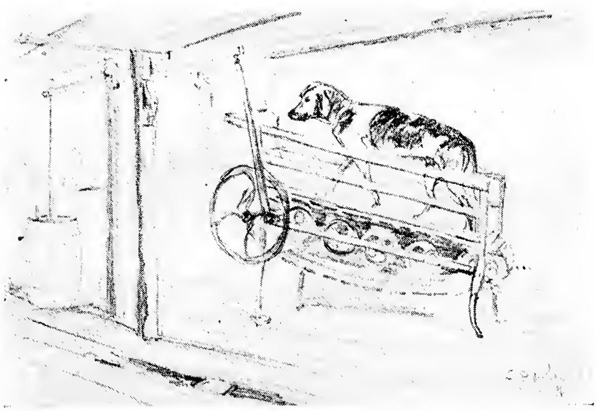


Figure 59 A pencil drawing in Sketchbook 3: CAT. 1187, used as a detail for figure 56. The page is signed, lower right: *Sparta, N. J., 1862*

Figure 60 A pencil drawing in Sketchbook 2: CAT. 1186, used as a note for figure 57

Figure 61 A sketch in a letter from Mrs Charles P. Daly to Henry, to document figure 58

Figure 62 *Village Post Office,* 1891: CAT. 248, a "lost" painting

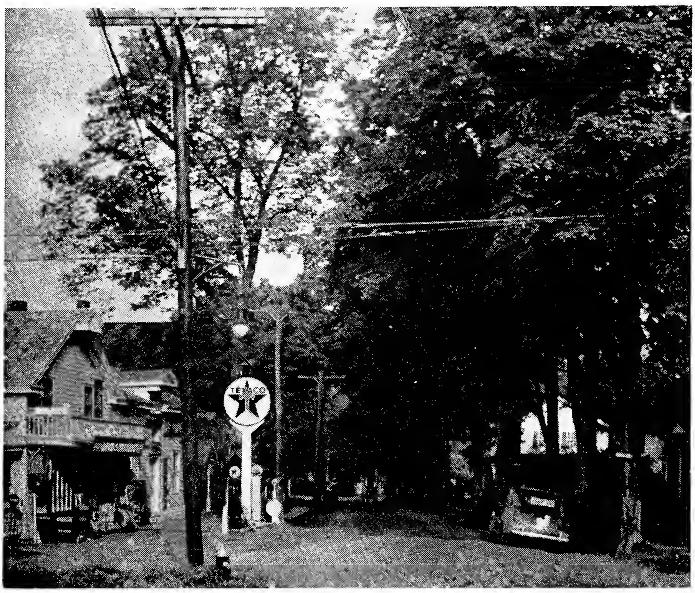


Figure 63 The old Jesse Low store, at the corner of Canal street and Cape road, Ellenville, as it looked in 1941

Figure 64 "Winter Scene, Jan. 6, 1880. Copy of Pencil Sketch, Milton W. Wright Place, LWB." A drawing by the "hermit of Cragsmoor," Legrand W. Botsford

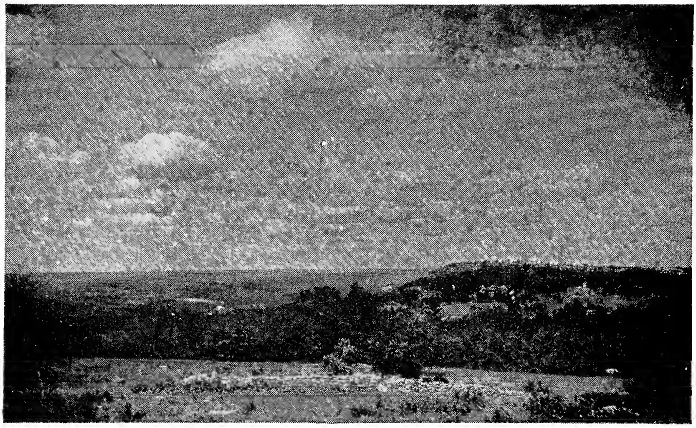


Figure 65 Cragsmoor landscape. "This is with the stone wall you spoke of . . . . I will sell the negative. Will be up in the morning with camera if the wind don't blow. LWB"

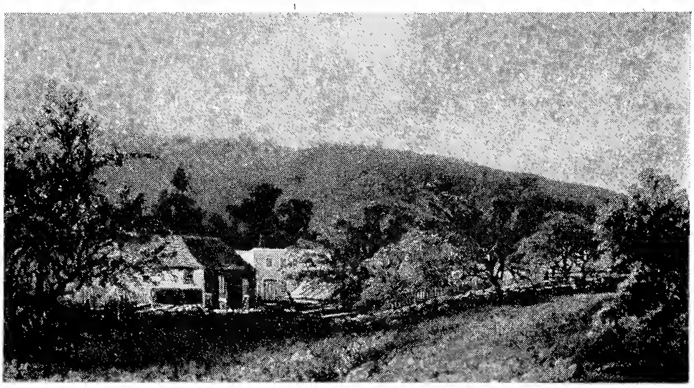


Figure 66 *Country Scene, circa* 1890: CAT. 233. Collection, Estate of Francis P. Garvan.

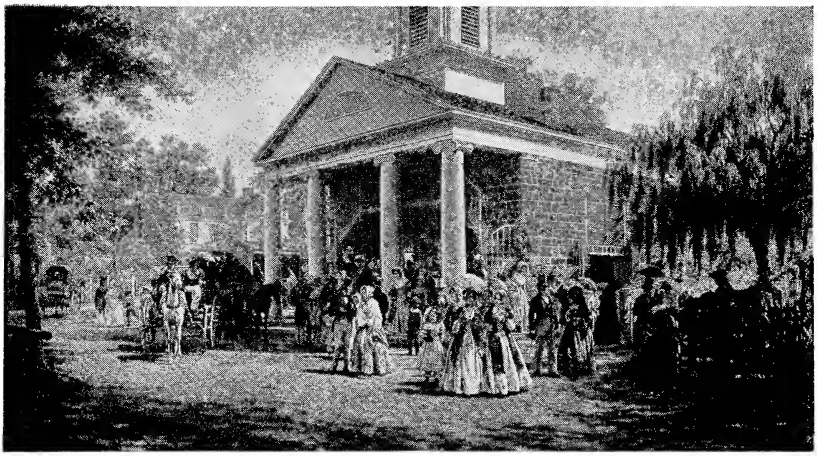


Figure 67 *Sunday Morning (Old Church at Bruynswick)*, 1898: CAT. 283. Collection, J. G. Myers Hilton. Note the four columns

Figure 68 The church at Bruynswick, N. Y., in 1941

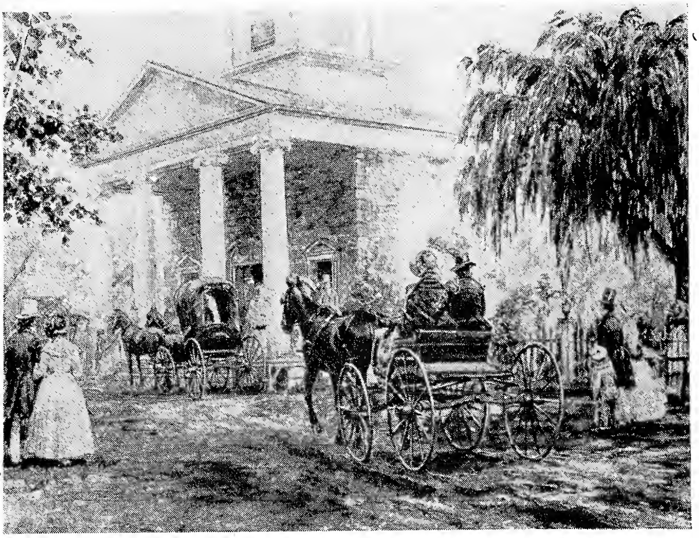


Figure 69 [*Bruynswick Church*] : CAT. 283-*a*

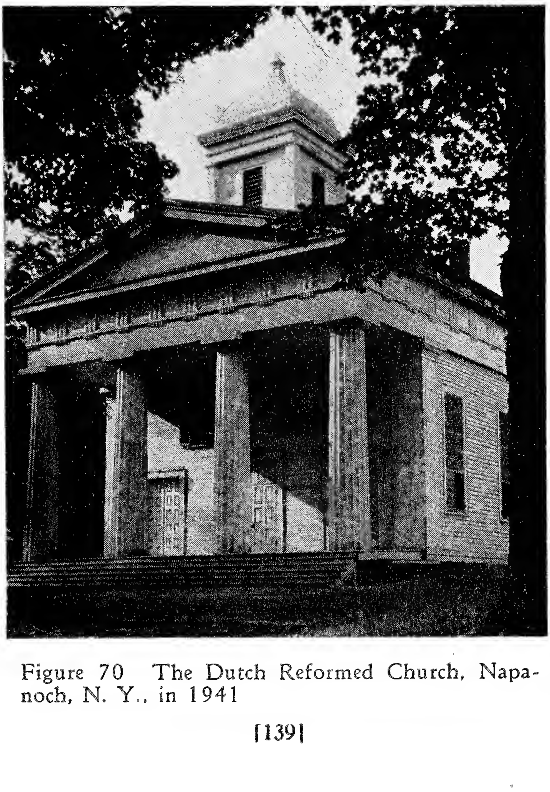


Figure 70 The Dutch Reformed Church, Napanoch, N. Y., in 1941

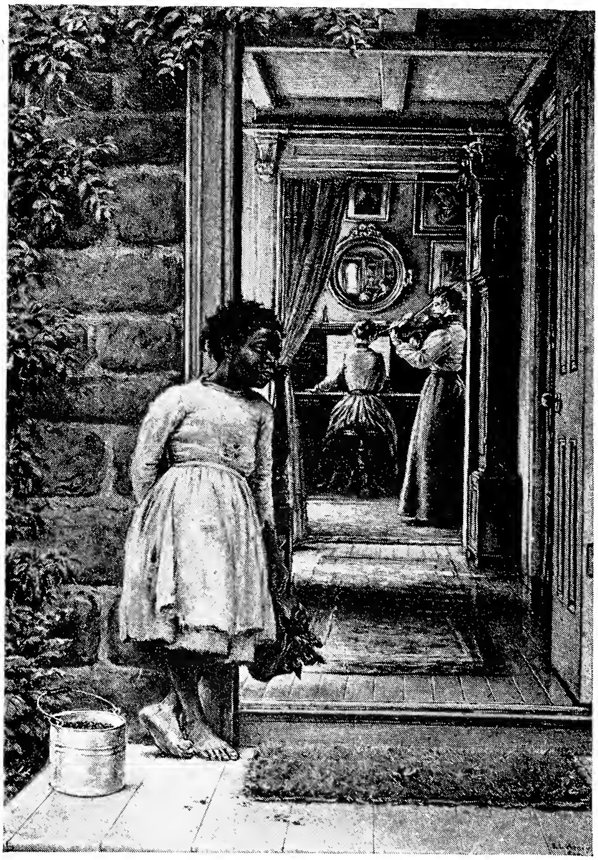


Figure 71 [*Maud Powell Plays the Violin*], 1904: CAT. 319

Figure 72 Maud Powell in Henry's studio at Cragsmoor

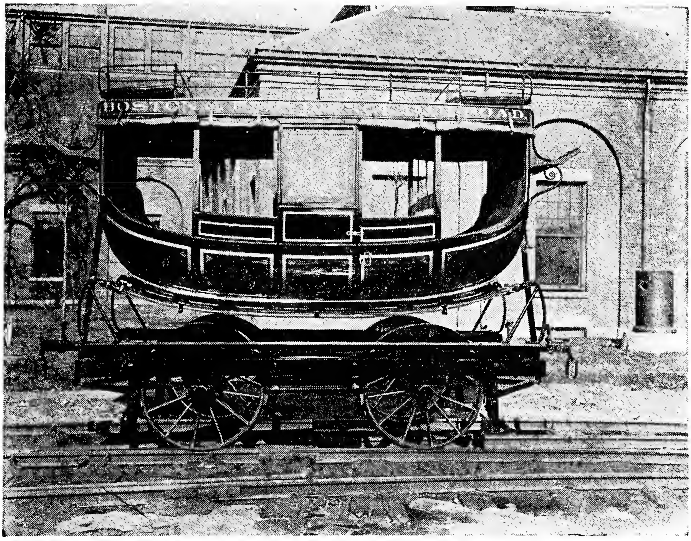


Figure 73 "R. R. Coach. From Boston and Providence Railroad"

Figure 74 "Mr Armstrong (Beth Chappell's husband) in one of my old fashioned coats and vest. July 1900"

Figure 75 Carriages collected by Henry. These went to the Johnstown Historical Society in 1922

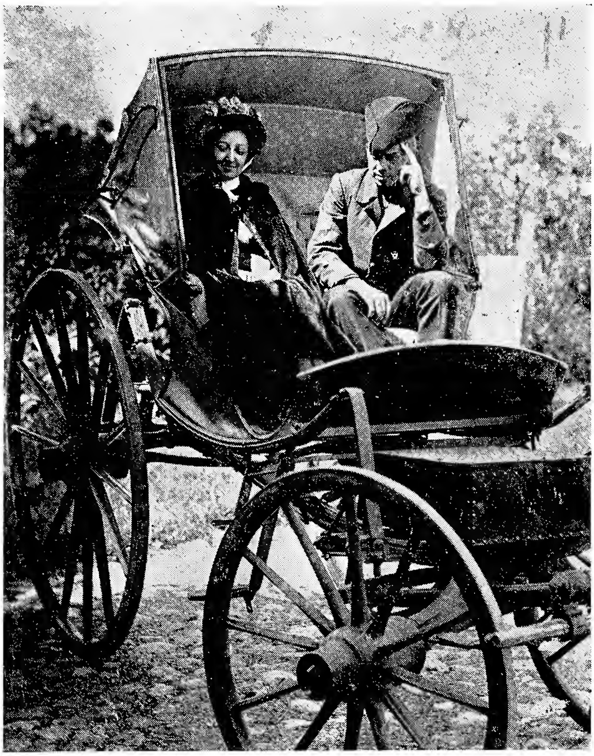


Figure 76 Mrs Lawrence Stetson and Mr Martin E. Albert in Governor Gansevoort's coach.

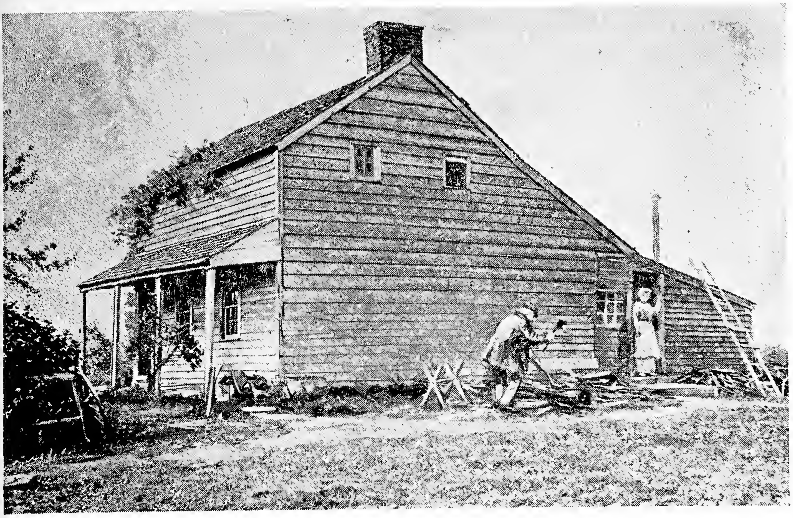


Figure 77 "Old Brown House (as it was in the old days.)" Photographed by Henry in 1880 and copied by Botsford in 1904. "The figures by the woodpile being playfully painted in, as he talked of the old days. LWB"

Figure 78 The Peter P. Brown house, 1941, owned at that time by Frederick Baker

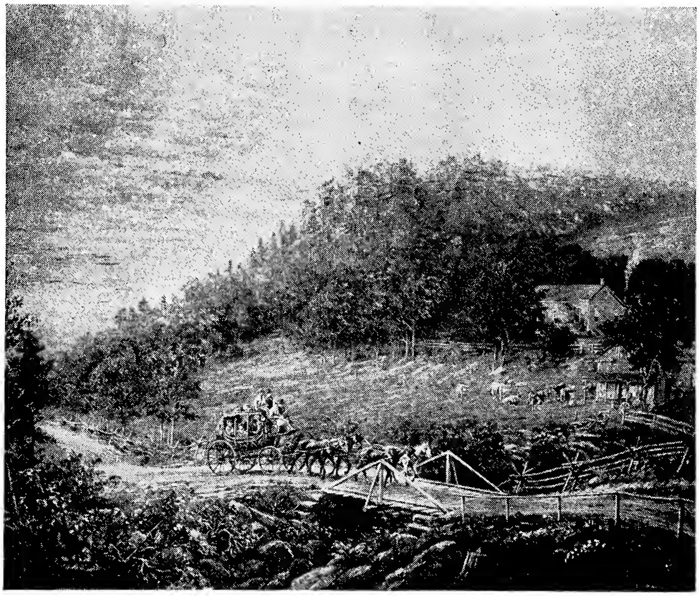


Figure 79 *Bear Hill,* 1908: CAT. 347. Collection, Martin E. Albert. (Photograph courtesy, Martin E. Albert)

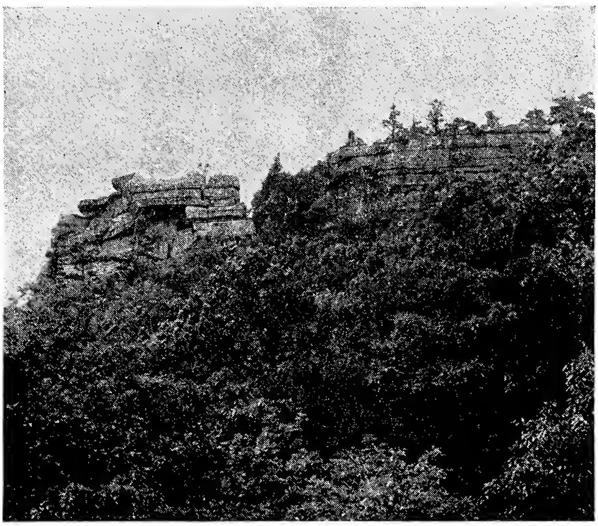


Figure 80 Bear Hill as it looked in 1941

Figure 81 *A Mountain Post Office*, 1900: CAT. 298

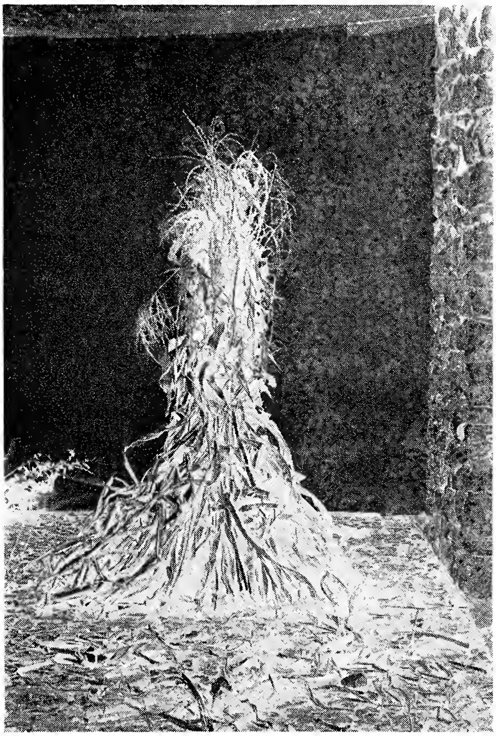


Figure 82 Transparency of a corn shock, possibly a detail for figure 205

Figure 83 *In the Valley:* CAT. 929, another "lost" canvas

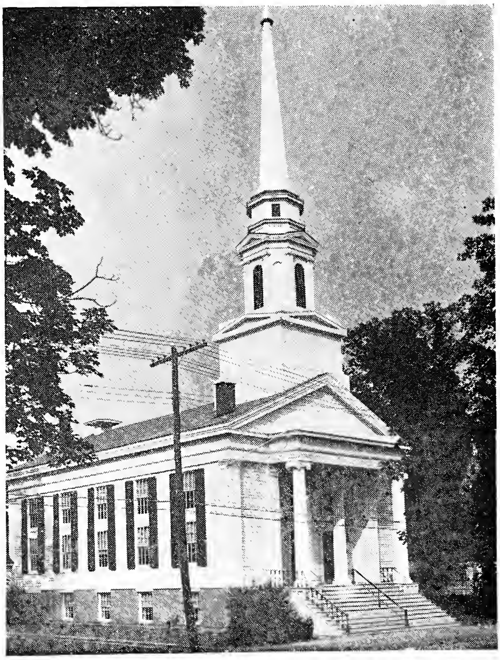


Figure 84 Dutch Reformed Church, Ellenville, 1941. The spire of this church may be seen in the painting above

A Catalog of the Work of E. L. Henry, 1858–1919

THIS CATALOG lists original works, including those of whose existence the only document is a reproduction (as photograph, platinotype or photogravure) or a reference in correspondence or printed material. Chronological order has been followed, rather than an elaborate system of cross reference, and in the first section of the catalog, drawings and sketches have been collated with oils and water colors for the ease of the reader in studying Henry's development. Measurements are given in inches, height first.

Abbreviations used are:

AL. Photographs of Paintings by E. L. Henry: An Album (see bibliography)

FIG. Figures in this catalog

KL. Reproductions of the Works of E. L. Henry N.A., Klackner, 1906 (see bibliography)

MS. A Memorial Sketch: "E. L. Henry N.A. His Life and His Life Work." A manuscript by his wife, Frances L. Henry, published in this report (p. 311–461).

NAD Annual exhibitions of the National Academy of Design

NO. Numbers used in this catalog

Italics are used to show the artist's signature or other identifying data in his hand. Identifying data from other sources are italicized, with source given. Brackets [ ] indicate attributed dates and titles.

The catalog is divided into the following sections:

Oils, Water Colors and Sketches: Dated

Oils and Water Colors: Undated

Sketches in Oil and Water Color on Wood, Canvas and Paper, in the Henry Collection

Sketches in Pencil and Pen and Ink on Paper, in the Henry Collection

Henry's Sketchbooks

Miscellaneous Works by Henry

Works Related to the Henry Collection

Oils, Water Colors and Sketches: Dated

This section comprises completed works and preliminary drawings for them, which can be dated with reasonable certainty.

1858

1 GREAT BEND, SUSQUEHANNA
Pencil on paper, 7x10 in.
Lower center: *Great Bend, Susquehanna*
Lower right: *Sept/58*
Collection: New York State Museum
Figure 85
The earliest known work of Henry. *Cf.* NO. 16

2 WEST POINT FROM PROF. WEIR'S
Pencil on paper, 5x8½ in.
Inscribed on mount as above
Collection: New York State Museum

Henry's acquaintanceship with influential people began early. Professor Weir taught drawing at West Point, having been Whistler's teacher. One of his sons, J. F. Weir, was director of the Yale School of Fine Arts for many years. A letter from him to Henry, dated April 19, 1897, indicates that the family friendship continued in later life. In the Henry papers there is no indication that Henry was particularly friendly with the better known son, J. Alden Weir, a leader among the early American Impressionists.

J. F. Weir's letter (on stationery of the School of Fine Arts) follows:

I am sending you by express a little souvenir of Dordrecht, where I spent a summer some years since. It is a sketch taken from Popindrecht, looking over the meadows toward Dordrecht. The black frame is Dutch in color at least, and seems to suit the sketch. This is for a "sweet remembrance," as I am often reminded of you as I go up our staircase, and I hope it will remind you of

Very truly your friend

Jno. F. Weir

Give my kindest regards to Mrs Henry

1859

3 BETHLEHEM, PA., 1859
Pencil on paper, 5¾x10 in.
Lower left as above
Collection: New York State Museum

On the back are two drawings: *Freight Engine* in pencil and *Express Locomotive about 1858* in water color.

4 ON THE LEHIGH, PENN., 1859
Oil on board, 9x13¼
Inscribed on back: *On the Lehigh, Penn., 1859, one of the first sketches from Nature of E. L. Henry*
Collection: New York State Museum

1859

5 MAUCH CHUNK, PA., SEPT. 1859

Pencil on paper, 7x10 in.
Lower center as above
Collection: New York State Museum
Figure 86
Cf. NO. 10

6 [BARNYARD: 1]

Pencil on paper, 6¼ x8⅞ in.
Collection: New York State Museum
Figure 88

7 [BARNYARD: 2]

Pencil on paper, ruled off to 3 9/16x6 1/16 in.
Collection: New York State Museum
Figure 89

This drawing shows the barn, corn crib, hay wagon and house seen in NOS. 9, 12, 13 and 14. Proportions have been changed, the paintings including more sky than the drawing.

Cf. also Sketchbook 1: NO. 1185

8 [BARN INTERIOR]

Pencil on paper, ruled off to 4x6⅛ in.
Collection: New York State Museum
Figure 90

The same architecture, vehicles and chickens may be seen in this drawing as in the other barnyard subjects. On the back is a sketch for NO. 13.

9 BARNYARD SCENE NEAR PHILADELPHIA

Lower right: *E. L. Henry '59*
Cf. NOS. 12, 13 and 14

This may be *Barnyard Scene,* NAD 1859, NO. 781. Of that painting, the Daily News (FIG. 228) wrote on Wednesday morning, June 8, 1859, as follows:

ACADEMY OF FINE ARTS—NO. VII

Northeast Gallery

No. 187, Barn-Yard Scene—Ed. L. Henry, Philadelphia. A very natural, conscientious, and well painted picture, beautiful in composition, by a young and most talented artist. We do not feel like seeking for its fault, being satisfied that Mr Henry only requires experience, combined with that judgment which we think he possesses, to enable him to repair and improve effectually any deficiencies which may be in this picture. We are much mistaken if there is not a foreshadowing of great excellence in this "Barn-Yard Scene."

"187" seems to be a transposition of "781"
AL. p. 43

10 BELOW MAUCH CHUNK ON THE LEHIGH RIVER

Exhibitions: NAD 1859, NO. 586
Cf. NO. 5

1860

11 [BARNYARD]

Figure 91

The photograph in the New York State Museum Henry Collection shows the same barn and house as are seen in NO. 14; but the house is turned so that its gable end faces out. *Cf.* NO. 9. Inscribed on the back of the photograph is the following: *Painted about 1863–4. Originally purchased by G. W. Stow of New York in the sixties. Afterwards taken for a debt by J. H. Brown of New York. After his death in 1880, held by his widow for a few years. Then sold at auction to a Philadelphia dealer, Hugh McCann. And afterwards turned up at a sale in Washington, D. C., in 1908 and* [was] *purchased by a Mr William T. Clerk of that city, who made this little photo copy of it. 1896–7.* It seems more correct to ascribe the earlier date to this work, as Henry was sometimes inaccurate in dating his pictures and as the other barnyard paintings (FIGS. 92 and 93) fall in the years 1859–60.

12 BARNYARD SCENE

Oil on board, 10x14 in.
Lower right: *E L HENRY* (capitals in red)
Exhibitions: NAD 1860, NO. 478; Century Association, 1942, NO. 2
Collection: Estate of Francis P. Garvan
Figure 92

This painting was formerly listed as *The Old Home in Dixie.* Pasted on the back of the stretcher is the Art News obituary of E. L. Henry.

13 FARM SCENE IN PENNSYLVANIA

Oil on board, 10x14 in.
Lower right: *E L Henry '60*
Exhibitions: NAD 1860, NO. 647; Century Association, 1942, No. 11
Collection: Estate of Francis P. Garvan
Figure 93

This painting was formerly listed as *Farmyard.*

14 [BARNYARD SCENE]

AL. p. 44
Cf. NOS. 12 and 13

15 WOODPILE

AL. p. 6

16 ON THE SUSQUEHANNA

AL. p. 8
Cf. No. 1
Cf. also the photograph in the New York State Museum Henry Collection, described in a printed label on the back as follows: *The Gap, from the East Side of the River. Evening. No. — Scenery in the Region of the Delaware Water Gap, Pennsylvania. Photographed by Moran & Storey, Philadelphia.*
Figure 87

1860

17 OFF TO EUROPE
Pen and ink on paper, $5\frac{11}{16}$x$7\frac{13}{16}$ in.
Lower right: *E. L. Henry, N. Y., Sept. 22, 1860* (with the date added in pencil, apparently later)
Lower left: *Off to Europe*
Collection: New York State Museum
Figure 229

1861

18 UNA VIA IN NAPOLI /61
Pencil on paper, 12x$8\frac{7}{8}$ in.
Lower right: *una via in Napoli /61; Naples Feby 1861*
Collection: New York State Museum
Figure 94
Cf. NO. 42

19 THE CAMPAGNA FROM FRASCATI
Pencil on paper, $5\frac{7}{8}$x12 in.
Lower left: *Frascati*
Collection: New York State Museum
Inscribed on mount as above

20 IN BELLA FIRENZE
Pencil on paper, $5\frac{1}{4}$x$8\frac{7}{8}$ in.
Lower right as above
Collection: New York State Museum
Figure 233
Inscribed on mount: *Fort Belvidere, Florence, from the Arno*
Cf. NO. 33

21 AU FOND DU LAC, COLICO, LAC DU COMO
Pencil on paper, $6\frac{1}{4}$x$8\frac{7}{8}$ in.
Lower left as above
Collection: New York State Museum

22 COLICO, LAKE OF COMO
Pencil on paper, $7\frac{1}{2}$x12 in.
Collection: New York State Museum
Figure 234
Inscribed on mount as above

23 LUINO, LAKE MAGGIORE
Pencil on paper, $7\frac{1}{2}$x$17\frac{1}{2}$ in.
Collection: New York State Museum
Inscribed on mount as above

24 LIVORNO, LAKE MAGGIORE
Pencil on paper, $7\frac{1}{8}$x$11\frac{3}{4}$ in.
Collection: New York State Museum
Inscribed on mount: *Livorno, Lake Maggiore, St Maria del Sasso*
Cf. NO. 37

1861

25 CANNSTADT IN WURTEMBURG, JUNI 1861
Pencil on paper, 6½ x11 in.
Lower left as above
Collection: New York State Museum
Figure 235
Inscribed on mount: *Die Rosenstein near Stuttgart and Palace of the King of Wurtemburg*

26 IN STUTTGART
Pencil on paper, 10½ x8⅞ in.
Lower left as above
Collection: New York State Museum
Figure 236
Inscribed on mount: *Street View in Stuttgart, Wurtemburg*

27 A BERLIN OMNIBUS
Pencil on paper, 4½ x6 in.
Lower right: *nach Berlin*
Collection: New York State Museum
Figure 237
Inscribed on mount as above

28 PRUSSIAN CANAL BOAT
Pencil on paper, 3 5/16x6 in.
Lower right: *nach Berlin*
Collection: New York State Museum
Figure 238
Inscribed on mount as above

29 ITALIAN SCENE
Exhibitions: NAD 1861, NO. 270
Collection: Isaac H. Brown, 1861–
NAD catalog note: *Now in Rome, Italy*

1862

30 IN AMSTERDAM
Pencil on paper, 11⅝ x8 in.
Lower right as above
Collection: New York State Museum
Figure 239

31 ROTTERDAM, APRIL '62
Pencil on paper, 8¼ x12 in.
Lower right as above
Collection: New York State Museum
Figure 240

32 ICEBERGS OFF BANKS OF NEWFOUNDLAND
Pencil on paper, 5⅝ x12 in.
Lower left: *ELH '62*
Collection: New York State Museum
Figure 241

1863

33 THE ARNO, FLORENCE

Oil on canvas, mounted on board, 10x11⅞ in.
Lower left: *E L Henry '63* (in red)
Bibliography: Our Heritage, 1942, p. 32, NO. 207
Exhibitions: Our Heritage, National Academy Galleries, 1942, NO. 207
Collection: National Academy of Design; NAD Catalog NO. 729
Henry's "diploma" picture on election to the Academy.

34 AN ITALIAN VETTURA

AL. Index and p. 7
Collection: James Thomson, 1864–?
Figure 232
Cf. Figures 230 and 231

35 VIA PALLOMETTE, NAPLES, AFTER A MODEL FROM NATURE

Exhibitions: NAD 1863, NO. 166

36 VIA SAN LUCIA

AL. p. 44
Cf. Figure 95

37 ST MARIA DEL SASSO, LAGO MAGGIORE

Exhibitions: NAD 1863, NO. 397
Cf. AL. p. 17; also NO. 24

38 RUSSIAN FLEET AT ANCHOR IN THE NORTH RIVER

A letter from Henry (from which the signature has been torn off and to which the Date *Nov. 1863* has been added later in pencil) refers to this painting. It reads:

To the Russian Consul General

I understand by the papers that the Russian Fleet will leave Boston next week. As I wish to present to the Admiral a painting of the Russian fleet at anchor in the North River, I would like to know how or in what manner I can forward the painting to him ere he leaves this country.

With respect, I am, dear sir,
Your obedient servant

On the back is the following:

To Admiral Lisoffsky, 1863, commander of the Russian Fleet for several weeks anchored off the Battery, New York City. The painting of the Russian Fleet by E. L. Henry was presented to the Russian Government and fully acknowledged by the Russian minister and consul at New York at the time—early in 1864.

1864

39 CANAL IN VENICE

AL. Index and p. 5

Exhibitions: NAD 1865, NO. 552, as *A Canal Scene, Venice*

Collection: James Thomson, 1865–?

A photogravure in the Henry Collection shows the subject reversed from the photograph in the Album.

40 THE ITALIAN MAN-OF-WAR, IL RE GALANTUOMO

Exhibitions: NAD 1864, NO. 83

41 NEAR PALESTRINA, ITALY

Exhibitions: NAD 1864, NO. 71

42 STREET SCENE IN NAPLES

Oil on canvas, 24x17 in.

Exhibitions: NAD 1865, NO. 568, as *Via. St Catarina, Naples;* Century Association, 1942, NO. 54

Collection: B. H. Moore, 1864—?; Century Association, 1942, gift of Mrs. J. H. Gibbons of Washington, D. C., in memory of her father, Richard S. Ely

Figure 95

Cf. NO. 18, 1078

A letter to Henry gives the following information:

Phila Jan 23/64

Dear Sir

Your picture has arrived & is much admired.

We heard that you were coming to the "Fair" in a day or two. Is this the case? We shall be pleased to see you, and also in relation to the picture, I had the pleasure of dining with Mr Bierstadt and other artists yesterday.

Respectfully

B. H. Moore

A note added at the top of the paper continues:

Your picture on exhibition has been sent to my house as those in charge did not know what to do with it, the exhibition having closed (Acad. Fine Arts)

43 SOUVENIR DE LAC MAGGIORE

AL. p. 39

44 STATION ON "MORRIS AND ESSEX RAILROAD"

AL. Index and p. 9

Exhibitions: Probably NAD 1864, NO. 56, *The Railroad Depot*

Collections: James Thomson, 1864—?

Figure 108

The photograph in the Album is inscribed *Old Station at South Orange, N. J., 1864,* though the printed index gives the title as above. The painting shows a station of the period. A coach, a wagon, a surrey, with people, are waiting for the train, while a Negro boy chases sheep across the track before the approaching train.

1864

45 CITY POINT, OCT. 1864

Pencil and pastel on paper, 8½x18½ in.
Lower left: *ELH, Oct. 1864*
Collection: New York State Museum
Figure 105
Inscribed on mount as above; also: (from left to right) *Sketch taken from Pilot House on a U. S. Transport. Down James River. Anchored vessels with stores waiting to discharge cargoes. "Double ender" (guard ship). Stores dock. Monitor. U. S. Mail Dock. Adams Exp. Barge. (Ltnt Grant's Hd Qurts) (Commander in Chief). Sutler's schooner. Gen Ingall's Hd Quarters. Mouth of Appomottax River.*
Cf. Figures 106 and 107

46 THE MARKET PLACE, WASHINGTON

Pencil and white chalk on paper, 6⅜x12½ in.
Lower left: *ELH, Oct. 1864, Washington*
Collection: New York State Museum
Figure 96
Inscribed: *The Market Place, Washington, sketched from the window of a hotel, Oct. 1864. Showing fortifications on the Virginia side of the Potomac, protecting the Capitol*

47 THE GREAT HORSE DEPOT AT GIESBORO ON THE POTOMAC BELOW WASHINGTON

Pencil and water color on paper, 11½x18½ in.
Lower left: *E. L. Henry Nov. 1864*
Collection: New York State Museum
Figure 97
Inscribed: *The great horse depot at Giesboro on the Potomac below Washington where horses were broken in & drilled for the two branches of the Service and where they were brought back to recuperate. Horses ready to be shipped on a Transport. Where the incurable & condemned Horses were shot. Dead animals loaded on barges & carried across the Potomac.*

48 NEAR HARRISON'S LANDING, LOWER JAMES RIVER

Pencil and pastel on paper, 11½x19½ in.
Lower left: *Near Wilson's Landing, Lower James River, sketched from the Pilot House on a Transport, Nov. 1864*
Collection: New York State Museum
Figure 98

The inscription is over writing which has been erased. A drawing in Sketchbook 4, called *Harrison's Landing,* shows the same subject. The gazetteer gives Harrison's Landing as the scene of important actions in this Civil War campaign.

1864

49 CITY POINT, VA., NOV. 1864

Black and white wash, 9x20 in.

Lower left: *E. L. Henry, City Point, Va., Nov. 1864*

Exhibitions: Century Association, 1942, NO. 4-*a*

Collection: Harry M. Bland

Figure 106

Inscribed further: *View from James River. From sketch taken from the pilot house of a transport, Nov. 1864*

Cf. Figures 105 and 107

50 U. S. TRANSPORT ON THE POTOMAC BELOW WASHINGTON: DURING THE WAR, 1861–1865

Water color on paper, 10x16 in.

Lower right: *E. L. Henry, Nov. 1864*

Collection: Bernard H. Cone

Inscribed: *Drawing made from a small boat on the river*

The name *John Brooks* is plainly lettered on the paddle wheel.

Data on the back: *Side-wheel Steam-boat JOHN BROOKS. Length 239.8, beam 31.4, depth of hold 10.8. Ran from Bridgeport, Conn., in 1859. At start of Civil War in the call for Steamboats was chartered for $600 a day and served in Virginia and Carolina waters. At the end of the war, returned to Bridgeport and ran for many years in New Hampshire and Maine waters. From 1890 to 1894, ran from Boston to Portsmouth*

Cf. NO. 90

51 WESTOVER, JAMES RIVER

Pencil and pastel on paper, 12¼ x19⅛ in.

Lower left: *Grant's Campaign, Nov. 1864. Old "Westover," James River, a Division Hd Qtrs, Army of the James*

Lower right: *Sketch Made from the Deck of a Transport. E L Henry, Nov. 1864*

Collection: New York State Museum

Figure 102

Cf. Figure 103

52 ON THE JAMES RIVER, VA.

Oil on canvas, 6x12 in.

Lower left: *E L Henry Nov. 1864*

Lower right: *On the James River, Va. Campaign of 1864*

Exhibitions: Century Association, 1942, NO. 39

Collection: Guy Mayer Gallery

Inscribed on back of canvas in pencil: *Study from Nature. Sunset effects through the smoke of the campfire of the Confederate armies from the James River below Richmond Landing. 1864. E L Henry*

53 THE RACES AT FLORENCE, ITALY

AL. Index and p. 11

Collections: J. P. G. Foster, 1865–?

This painting is titled as above in the index of the Album, but inscribed under the photograph: *Spring Races at Florence, Italy.*

Cf. also a photograph in the Henry Collection inscribed: *The Race Course at Florence, Italy. From pencil sketches made at the time.* Dated: *1864*

1865

54 THE JOHN HANCOCK HOUSE
Oil on wood, 7x8¼ in.
Lower center: *E L Henry '65*
Exhibitions: Century Association, 1942, NO. 21
Collection: Estate of Francis P. Garvan
Figure 43
Cf. Figure 44

55 RESIDENCE AT POUGHKEEPSIE
AL. p. 39
Inscribed: *Owned by the late Robt Sanford*

56 ST ERASME, GAETA, ITALY
AL. index and p. 13
Exhibitions: NAD 1866, NO. 438
Collection: William E. Dodge, 1865–?

57 WESTOVER, VA., 1863
Oil on wood, 12x14 in.
Lower right: *E L Henry*
Exhibitions: NAD 1867, NO. 294, as *Westover, James River, Campaign of 1863;* Century Association, 1942, NO. 60
Collection: Century Association
Figure 103
Cf. NO. 51; also MS. p. 319; also AL. Index and p. 15

This painting is titled as above on the card fastened to the frame. The date *1863* is an obvious error, probably the artist's, as the James River campaign was fought in 1864, the year in which Henry served with the commissary of the Union Army.

1866

58 AN AMERICAN RAILROAD STATION
AL. Index, No. 9
Collection: John Taylor Johnson, 1866–?

At the sale of his collection in 1876, a painting was sold, No. 41, *Railway Station, Westchester,* 16x30 in. It may be the same painting.

59 THE GRAND HALL, LEVENS, WESTMORELAND
AL. Index and p. 23
Exhibitions: NAD 1867, NO. 494, as above.
Collection: C. J. Peterson–?

The printed index of the Album gives the title as follows: *Drawing Room of Levens Hall, Westmoreland, England,* though Henry has given the above title under the photograph on p. 23 of the Album. The notation dates the picture as *1868.* But this is obviously incorrect, from the NAD entry, as well as from a letter from Peterson to Henry, dated February *2, 1865: Mrs Peterson is looking for something very fine. "Levens" will be her pet picture, if it equals what she expects.*

1866

60 [THE MAIL CARRIER]

AL. p. 58

A photograph in the Henry Collection is inscribed: *The mother of our old housekeeper, Mrs Jane Morgan of North Wales. She carried the mail. Painted from this little photograph sent over by the Countess of Vane to the old woman's daughter here in New York City.*

61 PORCH SCENE, NEWPORT, R. I.

AL. Index and p. 21

Lower right: *E L Henry, 1866*

Collection: T. A. Vyse, 1866–?

Figure 37

Cf. Figure 35

62 FROM A WINDOW, NEWPORT

AL. p. 39

Figure 34

Another photograph in the Henry Collection is inscribed: *From a Sketch after Nature, July 1866, Jessup's, Newport, R. I.* This painting may be the inspiration for the heavily carved walnut frame, now in the Henry Collection. *Cf.* Figure 41

63 SOUVENIR OF A TRIP TO NANTUCKET

AL. p. 3

1867

64 FOUR-IN-HAND, CENTRAL PARK, NEW YORK

AL. Index and p. 16

Lower left: *E L Henry, 1867*

Collections: T. A. Vyse, 1867–?

Figure 38

Photograph in Album is inscribed: *1867. Mrs. Vyse, her sister, Miss Power, & E. L. Henry. Thos. A. Vyse driving. The Four-in-Hand of the late Thos. A. Vyse in Central Park.*

65 THE 9.45 A.M. ACCOMMODATION, STRATFORD, CONNECTICUT

Oil on canvas, 16x30⅝ in.

Lower right: *E. L. Henry P. 1867*

Bibliography: Life in America, pl. 212; Metropolitan Museum of Art Bulletin, June 1939, Vol. 34, No. 6, p. 137–38, "The Moses Tanenbaum Bequest"; Magazine of Art, June 1939, p. 332; Life, June 19, 1939, p. 30; "Our Heritage," 1942, p. 29, NO. 179

Exhibitions: Life in America, Metropolitan Museum of Art, 1939; Our Heritage, National Academy Galleries, 1942, NO. 179; Century Association, 1942, NO. 32

Collections: Moses Tanenbaum; Metropolitan Museum of Art

Figure 109

A photograph in the Henry Collection shows what seems to be another version of the subject, with minor changes. The architecture of the houses

1867

at the right is different. The man in the wagon at the extreme right is whipping his horses. At the extreme left, the woman running wears a different costume and does not lead a child. Details throughout show such alterations.

Of the above painting, the Metropolitan Bulletin writes: *Henry's picture . . . is all human activity, all bustle and confusion. Here is the fine puffing engine that frightens horses and little children, here are the houses and station that man has made for his comfort and convenience, here are his wagons, his trunks, his horses, his dogs, and here is man himself, a very bee for busyness. And how this scene has changed since the artist's time! The wood-burning locomotive may have been the iron monster of its day—it seems but a toy to us, its antlered lamp, its bell and all, charming us with their quaintness. And did the owners of the pretty houses realize that this pleasant little train would soon grow up and drive them from their once gracious and quiet homes and turn the neighborhood topsy-turvy? Perhaps they did, but here in 1867 it is still all very fine, all very gay—a veritable feast for the eyes. Louise Burroughs*

66 A NEW YORK REGIMENT LEAVING FOR THE FRONT TO REENFORCE THE ARMY OF GEN. GRANT. SCENE, NEW JERSEY RAILROAD TERMINAL, 1864–5
Black and white wash drawing on paper, 11¾x19½ in.
Lower right: *E L Henry, 1864–7*
Collection: Albert Duveen
Figure 101
Cf. NO. 85

67 THE WARNING
Lower left: *E L Henry*

A photograph in the Henry Collection is inscribed on the back: *The Warning: An Episode in the Valley of Virginia during Campaign of 1864. Owned by Dr Sternberg, N. Y.*

67-*a*. THE WARNING
Oil on paper, 14½x20¼ in.
Lower left: *E L Henry*
Exhibitions: Century Association, 1942, NO. 58
Collection: Albert Duveen
Figure 104

68 THE MONASTERY OF ST MARIA DEL SASSO
AL. Index and p. 17
Collection: A. D. Jessup, 1867–?

69 SANTA SPIRITO, FLORENCE, ITALY
Exhibitions: NAD 1867, NO. 363
Collection: Henry Dallett, 1867–?

1868

70 THE OLD CLOCK ON THE STAIRS

AL. p. 33

Lower right: *E L Henry*

Exhibitions: NAD 1869, NO. 406, as *The Clock on the Stairs;* International Exhibition, Philadelphia, 1876, NO. 258

Collection: Robert Gordon, London, 1869–1918

Cf. MS. p. 320; also NO. 379; also Sketchbook 7, which notes: *20 stairs, 6 panels* etc. for this painting; also NO. 81

In the Henry Collection there are several photographs of the subject, one inscribed: *To Miss Frances M. Wells, 1874, Compts of E. L. Henry.*

The most informative inscription is: *A Study after Nature in lower Spruce Street, Philadelphia, in 1866. Purchased by Robert Gordon, a banker of London. His residence was at Sydenham, near London, where this picture is. He died there early this year, 1918.*

Cf. Figure 214

Cf. CORR. December 24, 1894

71 THE INVALID

AL. Index and p. 27

Exhibitions: NAD 1870, NO. 233

Collection: Dr J. D. Haren White, 1868–?

The photograph in the Album is inscribed: *Portrait of Miss Kate White, Philadelphia, died February, 1868*

In the Henry Collection there is photograph, colored by hand, on the back of which a visiting card has been pasted. There is a further notation by Henry: *Born 1846. Died 1868*

72 THE LIBRARY OF JONATHAN THORNE, 526 FIFTH AVENUE

AL. p. 43

Figure 39

A photograph in the Henry Collection is inscribed: *Mr and Mrs Jonathan Thorne in their parlor, Fifth Avenue near 44th Street. 1868. Just after they were married.*

73 ["A COLD DECEITFUL THING IS THE SNOW"]

AL. p. 30

Lower left: *E L H '68*

This seems to fit the arch-shaped frame shown in Figure 41

Under the photograph in the Album the following verse is written:

A cold deceitful thing is the snow
Though it come on dovelike wing
the false snow
'Tis but rain disguised,
appears
And our hopes are frozen
tears
like the snow.

1868

74 GEN. FITZJOHN PORTER'S HEADQUARTERS, JAMES RIVER

AL. p. 43

This seems to be a second version of *Westover*. A letter to Henry from C. J. Peterson, dated February 2, 1865, may bear on the question. It reads, in part, as follows:

I did not answer your last letter . . . because I expected, before this, to have had the James River picture, and, with it, an occasion for writing.

I fear, now, that you have not had time to paint the picture, for the exhibition where you were to show it came off, I believe, more than a week ago. If you have painted it, I should like to have it, as soon as is convenient to yourself. How shall I remit? By my check?

75 AFTER THE BATTLE

AL. p. 45

Inscribed: *Souvenir of the Peninsular, 1864*

76 THE TERRACE AT HADDON

Exhibitions: NAD 1868, NO. 335

77 A CHAT AFTER MEETING

AL. p. 43

Collection: J. W. Pinchot, 1868–?

Figure 114

78 FACADE OF CATHEDRAL PIACENZA, LOMBARDY

AL. Index and p. 25

Collection: Robert Hoe, 1868–?

A note from R. Hoe, dated June 15, 1868, reads:

Please send the picture by bearer. I intended to come & see you today but am much engaged & I may be absent on business for several days.

Cf. the photograph in the Henry Collection, which seems to be reversed, to judge by the signature. This reads in mirror image: *E L Henry Pxt*

79 ST JOHN'S CHURCH, VARICK STREET, NEW YORK: 1866

Oil on board, 6½ x4½ in.

Lower left: *E L Henry '68*

Exhibitions: Collections in Hartford, Wadsworth Atheneum, 1936; Century Association, 1942, NO. 49

Collections: Misses Welcher, Hartford; Macbeth Galleries

Figure 112

Cf. NOS. 324 and 325; also clippings in Henry files.

A large photograph (15½ x21¾ in.) of this subject in the Henry Collection is inscribed on the back as follows: *Old Dry Plate Negative. Taken by Rockwood by order of E. L. Henry. Winter of 1866–7, as the City Government had to or was about to commence to cut down the trees & destroy the old park to make way for a freight depot for the N. Y. Central R. R. through the efforts, &, &, of William H. Vanderbilt.*

The unidentified newspaper clipping quoted under NO. 89 writes: *St. John's Chapel, before the old trees surrounding it were cut down, and the fine park in front was not covered with a mass of brick and mortar, has also an existence on his canvas.*

1868

80 ST PAUL'S CHURCH: 1766

Oil on board, 8x5¾ in.

Lower left: *E L H '68*

Exhibitions: Collections in Hartford, Wadsworth Atheneum, 1936; Century Association, 1942, NO. 50

Collections: Misses Welcher, Hartford; Macbeth Galleries

Figure 113

81 [OLD WOMAN READING]

AL. p. 42

The model seems to be the aunt of William Kulp, Philadelphia antiquarian; she posed for NO. 70.

Mortimer E. Barnes, Westbury, L. I., has a small oil on cardboard, 5¾x9 in., signed, lower left: *E L Henry '70*, which seems to be related. It is inscribed on the back: *The old back sitting room. Souvenir of Phila Quaker families. E L Henry*

1869

82 A PRESENTATION OF COLORS TO THE FIRST COLORED REGIMENT OF NEW YORK BY THE LADIES OF THE CITY IN FRONT OF THE OLD UNION LEAGUE CLUB, UNION SQUARE, NEW YORK CITY IN 1864

Oil on canvas, 17x26½ in.

Lower right: *E L Henry 1869*

Collection: Union League Club

Figure 100

82-*a* PRESENTATION OF COLORS

Pen and ink on paper, 3⅜x4¾ in.

Unsigned and undated

Collection: New York State Museum

Figure 99

Inscribed on back: *To be painted by Mr Henry, 17x26 for*
the Union League Club for 500$
Presentation of Colours
by the Ladies of NY
to the 1st NY Coloured Reg.

83 OLD DUTCH CHURCH, NEW YORK

Oil on canvas, 18x14 in.

Lower right: *E L Henry 1869*

Bibliography: *Life in America*, pl. 213; Valentine's Manual of New York, 1916

Exhibitions: NAD 1869, NO. 383, as *Middle Dutch Church, Fulton Street;* Life in America, Metropolitan Museum of Art, 1939; Century Association, 1942, NO. 37

Collections: S. P. Avery; Metropolitan Museum of Art

Figure 110

1869

The unidentified newspaper clipping quoted under NOS. 79 and 89 reads: *New York can thank him for preserving in this manner several old landmarks fast disappearing before the march of improvement. Among these are the New York Hospital . . .; also, the old North Dutch Church in William street before its curtailment by the vandal hands of workmen, or fire had toppled over its spire and destroyed the carved memorial above its doorway.*

84 THE OLD WESTOVER MANSION
Oil on canvas, 11x13 in.
Lower right: *E L Henry '69*
Collection: Corcoran Gallery of Art
Cf. NOS. 51 and 57

85 DEPARTURE FOR THE SEAT OF WAR FROM JERSEY CITY
AL. p. 41
Exhibitions: NAD 1869, NO. 398, as *Departing for the Seat of War*
Collection: Charles E. Gregory, 1869–?
Cf. NO. 66; also two photographs in the Henry Collection, one an albumen print, the other colored in oils, the first called *A New York Regiment Leaving Jersey City for the Front, March 1864*, the second *Embarkation of Troops, Weehawken.*

86 GRAEME PARK, NEAR PHILADELPHIA
AL. p. 46

The photograph in the Album shows a colonial interior, with a man and a woman in period costume sitting before the fireplace. A second woman opens the door at the right as a man enters, lifting his tricorne.

Two photographs in the Henry Collection show exterior views of Graeme Park. One is inscribed on the back: *End View, Graeme Park, at Horsham. Built by Sir William Keith, 1720–22, near Philadelphia. Gov. of Penn. 1720 to 1727. Full of Historical Associations. The Home of Lady Elizabeth Ferguson of Revolutionary Memory.* The other photograph is inscribed on the back: *"Graeme Park." Built 1722 by Sir Wm. Keith. Gov. of Penna. 1720 to 1727. At Horsham near Philadelphia*

87 INTERIOR OF HOPE LODGE
AL. p. 27

88 [REVOLUTIONARY INTERIOR]
AL. p. 38
An interior with a couple in period costume

1870

89 THE LIBRARY OF A. H. WARD
AL. p. 32
Lower right: *E L Henry*
Exhibitions: NAD 1870, NO. 340, as *Interior of a Library*
Collection: Miss Ward, 1870–?

The photograph in the Album is inscribed: *Old Mr Ward in his Library, Waverly Place. Painted from life.*

1870

An unidentified newspaper clipping, probably of 1869, adds: *At present Mr Henry is engaged in painting the interior of the library of the late A. H. Ward, Esq., in Washington Place, with a portrait of the deceased therein. The room is a copy of Sir Walter Scott's library at Abbotsford, with oak ceiling and panelling. The coats of arms and heraldic devices belonging to the family of Mr Ward, together with portraits on glass of English and Scottish poets, also adorn its walls.*

Cf. Sketchbook 7 for a notation: *Ward's Room, 22 feet long. 15 Do wide. 16 feet high.*

90 [U. S. TRANSPORT ON THE POTOMAC]
AL. p. 62
Cf. NO. 50

1871

91 INDEPENDENCE HALL
AL. p. 49
Lower right: *E L Henry '71*
Exhibitions: NAD 1872, NO. 159
Collection: James W. Drexel, 1872–?
The photograph in the Album is inscribed: *Independence Hall, July 8, 1776; after signing the Declaration of Independence, July 4, 1776*

92 LADY ELIZABETH FERGUSON SENDING A LETTER TO GEN. JOSEPH REED OF REVOLUTIONARY MEMORY, JULY 28, 1778, AT GRAEME PARK NEAR PHILADELPHIA
AL. p. 19
Lower left: *E L Henry '71*
A further note in the Album reads: *Vide Mrs Ellett's Houses of the Revolution, vol. 1, 1828*

93 NORTH PORCH. CATHEDRAL OF BERGAMO
AL. p. 47
Exhibitions: NAD 1871, NO. 333
Collection: G. F. Tyler, 1871–?

94 AN UNEXPECTED ATTACK
AL. p. 61
Exhibitions: NAD 1872, NO. 192
Collection: A. Bierstadt, 1872–?

95 [THE SNOWSTORM]
AL. p. 17
Lower left: *E L H '71* (reversed, a mirror image)

1872

96 CITY POINT, VIRGINIA. HEADQUARTERS OF GENERAL GRANT (1822–1885)
Oil on canvas, 29¾ x61 in.
Lower right: *E L Henry, 1865–1872*
Bibliography: *Life in America,* pl. 191; *American Battle Painting: 1776–1918,* p. 57 and pl. 26
Exhibitions: Life in America, Metropolitan Museum of Art, 1939; Century Association, 1942, NO. 4; American Battle Painting, National Gallery of Art, 1944, Museum of Modern Art, 1944

1872

Collections: Union League Club; Stephen C. Clark; Addison Gallery of American Art, Andover, Mass.
Figure 107
Cf. Figures 105 and 106

The photograph in the Henry Album (p. 29) is comprehensively documented. From left to right the inscriptions read:

Transport disembarking troops, horses
Mail dock
Adams Exp. Barge. Embalmed bodies being sent north. Andy Hepburn's barge. Head sutler. Captain's gig
Grant's Hd Qts
Gen. Ingal's Hd. Qts
15-inch Mortar & 2 Hundred Pound parrots on platform cars. Mouth of Appomattox
Schooners with stores, forage, & lumber swinging to the current
Monitor in the distance, Bermuda Hundreds

97 NO. 217 E. 10TH, N. Y.
Oil on paper, 21x14 in.
Lower left: *E L H '72*
Lower right as above
Collection: Albert Duveen

About an inch of paper has been added at the bottom of the painting, which shows a snow scene. A cutter with one bay horse is hitched in front of a three-story red brick house. Henry lived across the street from this subject.

Cf. Figure 19

98 A PARLOR ON BROOKLYN HEIGHTS
AL. p. 50
Figure 40

Another photograph in the Henry Collection is inscribed: *The parlor on Brooklyn Heights of Mr and Mrs John Bullard overlooking East River and New York City. Painted from Nature for them.*

99 THE PASSION PLAY, OBERAMMERGAU
Ortgies catalog, 1887, NO. 60

An unidentified clipping (pasted on an unnumbered page of the MS. following MS. p. 58) reads as follows: *There is now on exhibition in the west window of Messrs. Bailey, Banks and Biddle, Twelfth and Chestnut Streets, a large painting by Edward L. Henry, representing The Passion Play as given at Oberammergau. The picture contains a large number of figures and is a fine piece of descriptive work, showing one of the closing tableaux of the play—the crucifixion. In the foreground is the large audience showing respectful attention to the grand scene being carried out, and the artist has grouped the figures in an attractive manner. In coloring and other respects the painting is well-executed, and is viewed daily by hundreds of admirers.*

Cf. MS. p. 327*f;* also NO. 100

The painting listed in the Ortgies catalog sold, according to Henry's annotated copy, for $165.

1872

100 ALT KIRCHE, OBERAMMERGAU
AL. p. 52
Figure 115
Another photograph in the Henry Collection is inscribed: *Alt Kirche, Oberammergau, where mass is held before the play. Collection, Hon. H. W. Bookstaver.*
Cf. NOS. 99 and 1080

101 [NURSE AND TWO CHILDREN]
AL. p. 48
Lower left: *E L Henry, 1872*
Cf. NO. 61

102 THE HICKSITE QUAKERESS
AL. p. 40
Lower left: *E L Henry '72*

103 THE YOUNG HEIR
AL. p. 40
Lower right: *E L Henry '72*

104 A COURTSHIP: TIME, 1817
AL. p. 61

1873

105 THE DOCTOR
Oil on cardboard, 9x12⅞ in.
Lower left: *E L Henry '73*
Exhibitions: Century Association, 1942, NO. 9
Collection: Estate of Francis P. Garvan
Figure 116
The doctor's name, *Dr H. P. Farnham,* is painted on the side of the horse block from which one mounts to the doctor's gig.
Cf. Sketchbook 8 for a detailed drawing, inscribed: *Dr H. P. Farnum's Visiting Buggy. W. 23d St. April 1874*

106 THE WIDOWER
Oil on wood, 8x5⅝ in.
No signature
Exhibitions: Century Association, 1942, NO. 62
Collection: Estate of Francis P. Garvan
Figure 117

107 A QUIET CORNER BY THE DOOR
AL. p. 36
Lower left: *E L H '73*
Figure 118
In the Henry Collection there is a print of this subject, colored by hand in oils and framed.

1873

108 A SUMMER MORNING
Oil on canvas, 9½x13½ in.
Lower left: *E L Henry '73*
Exhibitions: Century Association, 1942, NO. 55
Collection: James Graham and Sons

A slip pasted on the back reads: *A Summer Morning. Artist, E. L. Henry. Price $100. 51 West 10th Street.* The painting shows a country landscape. A man in a red shirt and a woman in a white sunbonnet are driving along in a wagon drawn by a white and a bay horse.

109 THE MEETING OF GENERAL WASHINGTON AND ROCHAMBEAU
AL. Index and p. 51, p. 53
Lower right center: *E L Henry, 1873*
Exhibitions: NAD 1874, NO. 217
Collection: W. H. Raynor, 1874–?
Cf. NO. 1020; Figure 222

1874

110 THE OLD PATERNAL HOME
Oil on cardboard, 9x8 in.
Lower left: *E L Henry, 1874*
Exhibitions: Century Association, 1942, NO. 38
Collection: Mabel Brady Garvan Collection, Yale University Art Gallery
Figure 119

This painting was formerly called *Group in a Colonial Doorway*

111 [THE DOCTOR'S CALL]
Oil on canvas, 13x12 in.
Lower left: *E L Henry '74*
Collection: Albert Duveen

The painting shows an old woman in cap and plaid shawl, watching the doctor make up powders, which he pours from a bottle into papers. Through the window his gig and horse may be seen outside.

112 TAKING A NIGHT CAP
AL. p. 14
Lower right: *E L Henry, 1874*
Exhibitions: NAD 1875, NO. 450; International Exhibition, 1876, Philadelphia, NO. 429
Collection: W. O'Brien, 1876–?

An old woman in a nightcap is heating water on a coal stove in her bedroom. A glass with a spoon in it stands on her bedside table, while a wicker-covered jug of rum may be seen underneath the table.

An unidentified clipping in the Henry Collection reads: *"Taking a Night Cap" is . . . elaborate and faithful in execution, representing an old lady in an old fashioned room sitting by the fire and brewing for herself a*

1874

hot whiskey toddy before retiring. The old-fashioned furniture, mantle ornaments, dress of the lady, who sits with a comfortable pet terrier in her lap, blinking his eyes at the fire, are admirably worked up. The artist, E. L. Henry, makes old American subjects a specialty, and has now on his easel an American battle scene, which promises well, and has recently completed an interview of American and British officers in Revolutionary times, which was much admired.

Cf. NO. 1085

113 [COLONIAL COUPLE]

AL. p. 28

A man and woman in period costume have just come down a flight of stairs and are going out a colonial doorway with a fanlight. A dog is running beside them.

114 RECEPTION GIVEN TO LAFAYETTE (AT THE CHEW HOUSE, GERMANTOWN, THE CONTESTED POINT AT THE BATTLE OF GERMANTOWN, OCT. 4th, 1778) BY HIS BRETHREN OF THE MASONIC FRATERNITY, MILITARY AND OTHER ORGANIZATIONS, AND BY THE TOWNSPEOPLE, JULY 20th, 1825

AL. p. 26

Exhibitions: NAD 1874, NO. 246

Collection: Samuel Chew, 1874–

115 GOING OUT TO RIDE: NEW YORK, ABOUT 1796

AL. p. 20

Lower left: *E L Henry*
L X X I V

116 SUNSHINE AND SHADOW

AL. p. 20

1875

117 FRANCES LIVINGSTON WELLS (HENRY)

Oil on board, 6x5 in.

Lower left: [name illegible], *1875*

Collection: Alida Wells Stetson, Edward C. Wells, Margaret L. Wells and William C. Wells; Albany Institute of History and Art

Figure 227

The painting is apparently in its original condition. It is in a gold frame, set in a deep black walnut shadow box, lined with plush now faded to ashes of roses.

Pasted on the back is a slip, reading: *Loaned to Mrs M. C. Murray during her lifetime. Then to be returned to E. L. Henry, New York City.* The date *May, 1905* has been added, possibly the date of the picture's return.

Probably the portrait was painted before the Henrys' marriage.

1875

118 LIBRARY AT THE HOME OF W^M^ LORING ANDREWS, 16 E. 38

Oil on wood panel, 9x7 in.

Lower left: *E L Henry 1875*

Exhibitions: Century Association, 1942, NO. 26

Collection: Century Association

There are two labels pasted on the back. The upper reads: *Painted by E. L. Henry. The old man is a fancy sketch. A daughter of E. L. Henry posed for the young girl.*

The unidentified writer was in error, for the Henrys had no children.

The lower label reads: *The above painting brought $200 at a sale at the American Art Galleries on April 10, 1931. But is incorrectly catalogued as The Grandfather: Interior of a Phila Living Room. J. E. Turkas. Ms. of Wm Loring Andrews.*

AL. p. 52

Cf. note pasted on manuscript p. 37, MS. (February 29, 1904) regarding possible purchase by Metropolitan Museum of Henry's railroad painting.

119 ST GEORGE'S CHAPEL, BEEKMAN AND CLIFF STREET, NEW YORK

Oil on wood, 10x8½ in.

Lower left: *E. L. Henry '75*

Exhibitions: Century Association, 1942, NO. 48

Collection: Metropolitan Museum of Art

Figure 111

This church was torn down in 1868 (McCausland '41, p. 180).

120 THE LITTLE CHICKS

Exhibitions: NAD 1875, NO. 438

121 [CHILDREN IN A GRAVEYARD]

AL. p. 53

Lower left: *E L Henry '75*

1876

122 PORTRAIT OF MRS HENRY

Oil on canvas, oval, 13¼x11¼ in.

Lower right: *London 1876*

Collection: New York State Museum

Figure 41

Mrs Henry is shown standing at an easel, palette and mahlstick in left hand, brush in right, painting a flower subject. This painting evidently was designed for a rectangular frame, as it has been pieced out to fill the oval frame, itself a piece of Henryiana. It shows up in numerous photographs of his studio at 51 West 10th street, New York, with various pictures in it. It is made of walnut, 24½x24½ in., and is heavily carved with flowers and leaves. The inset oval frame, 17x15 in. outside, is gilded, and measures 13¼x11¼ inside.

A letter written 28 years later to Martin Albert (*Cf.* NO. 315) gives a clue to Henry's taste in presentation. He writes of *feeling that the dark wood helped make the contrast greater like looking out of doors from a window.*

Cf. also Figure 34, actually the view through a window at Newport.

1876

123 ALL HALLOWS, GREAT AND LESS: THOMAS STREET, LONDON
4 water color sketches on paper
Exhibitions: Architectural League, New York, 13th annual, 1915
Collection: New York State Museum
1 *Interior of the Church . . . and the Noted Rood Screen*
Water color on paper, 21½x26¼ in.
Lower left: *London, 1876*
2 *Arms of the Hatters' Guild*
Water color on paper, 7¾x4½ in.
3 *The Noted Wood Carved Pulpit and Clerk's Desk*
Water color on paper, 9x6¾ in.
4 *Wood Carving on Rear Pews*
Water color on paper, 5¼x5¾ in.
NOS. 2, 3 and 4 are on one mount.

124 OFF FOR THE RACES
Oil on canvas, 10⅛x18⅝ in.
Lower right: *E L Henry 1876*
Exhibitions: NAD 1877, NO. 271, $500, illustrated, 12x20; Century Association, 1942, NO. 33
Collection: Fairman Rogers, Philadelphia, 1878–?; Estate of Francis P. Garvan
Figure 122
On the stretcher is written: *Fairman Rogers. West Rittenhouse Square, Philadelphia, U. S.*
In the Henry Collection, there is a framed photograph (11¼x20 in.) of this subject. The photograph has been touched up with black and white and is signed lower right *E L Henry, Warwickshire, 1882.* A slip pasted on the backing reads: *"Off For the Races" a study from Nature of old St John's, Warwick, England, belonging to Lord Brooke. Painted July 1876. The painting from this study was purchased by the late Fairman Rogers, Philadelphia, in 1878. E. L. Henry*

125 [FEEDING THE DUCKS]
Oil on canvas, 24x16 in.
Collection: New York State Museum
Figure 123
Gift of Wilfred Thomas

126 WARWICK, ENGLAND
AL. p. 14
Lower right: *E L Henry, Warwick, 1876*
This may be *A View of Warwick, England, from the Commons,* sold for $100 at the Ortgies sale, 1887, NO. 66.

127 INTERIOR OF AN OLD ENGLISH MANSION
Exhibitions: NAD 1876 (50th annual) NO. 77, $150
Cf. AL. p. 57. The photograph there shows the interior of an English castle, which may be the above painting.

1876

128 LES FOSSES COMMUNES, CIMITIERE DE ST OWEN, PARIS
Oil on canvas, 19x32 in.
Lower left: *E L Henry, Paris 1876*
Exhibitions: NAD 1877, NO. 159, $500
Collection: New York State Museum
Figure 121

128-*a* LES FOSSES COMMUNES
Pencil and pen and ink on paper, 5¾ x10⅛ in.
Lower right: *E L H*
Collection: New York State Museum
Figure 120

129 A PARIS DILIGENCE
Exhibitions: NAD 1876 (50th annual) NO. 85, $150

130 WILLIAM FLOYD

A photograph in the Henry Collection is inscribed: *Original copied by E. L. Henry for Independence Hall, Philadelphia, Nov. 1874. Presented by David Floyd, Greenport, L. I., Nov. 1874.*

A letter from Henry printed in the American Art News in 1917 gives a little history connected with this painting. It reads:

Those Philadelphia Portraits

Editor AMERICAN ART NEWS

Dear Sir:

In reading the editorials in your paper and your quotations from others in connection with the supposed "Fake" pictures in Independence Hall, Phila., I would like to add a word as in 1875 I served on a committee for restoration of the building having the "expert" advice of the late Daniel Cotier and the late James Renwick, also early in 1876 I was given a commission to copy a portrait of one of the "Signers," Wm Floyd—the original being at the ancestral home, at Greenpoint, L. I.

I can still feel the deathly chill of the parlor where I had to work from the original, almost at the risk of pneumonia. Several other artists were also given commissions to copy other originals, there being no known copies or portraits of the few that were left. They closed up the list with what they had and so the controversy over the supposed "Fakes" is to me a very mistaken conclusion, and partly one of a new committee which does not seem to have made much of an investigation whether they are originals, copies or so-called "Fakes" and want to throw them all "out." Perhaps to be able to get "new jobs" for some of their artist friends.

While in Paris in 1875, I made an oil study of the Tomb of La Fayette at the Cimitiere Picpus.

I presented it to the City of Phila. to hang in Independence Hall. Two years later, on visiting the city, I found the work covered with dust and dirt. They promised to "clean it off." Evidently the "job" was given to some poor char woman who used probably sand soap, for in visiting the hall again later, I found most of the iron railing around the tomb nearly

1876

all erased and all of the lettering on the tomb, as well as the Mural Tablets rubbed off entirely. Also the tablet reading "Tomb of La Fayette, Cimitiere Picpus," was all gone and a new tablet in its place reading "Tomb of La Fayette—Pere le Chaise" the latter not being known as a cemetery until many years later, but what a hard lesson to learn to whom to give it to.

Yours very truly

E. L. Henry

N. Y. Mar. 12, 1917

1877

131 THE ANCESTRAL HOME
AL. p. 55
Lower right: *E L Henry*
Exhibitions: NAD 1877, NO. 195, $1500, illustrated, 39x29; Gill 1879, *The Ancestral Home (An Elizabethan Manor, property of Earl of Warwick)*

131-*a* [THE ANCESTRAL HOME]
Pen and ink on paper, 8x6⅝ in.
Lower right: *E L Henry '76*
Collection: New York State Museum
Cf. Sketchbook 6

132 TENTH STREET STUDIO BUILDING
Oil on canvas mounted on board 11x8 in.
Lower left: *E L Henry Feb. 1877*
Lower right: *E L H*
Bibliography: "Our Heritage," 1942, p. 31, NO. 203
Exhibitions: Our Heritage, National Academy Galleries, 1942, NO. 203
Collection: National Academy of Design; NAD Catalog NO. 725
Figure 258

The painting was acquired by the Academy in 1911, the gift of the artist as a memento of the old Studio Building at 51 West 10th street. A letter and note attached to the back of the painting tell the story:

Cragsmoor, N. Y., Oct. 8th, 1911

My Dear Maynard:

Thank you so much for your letter in relation to the sketch of the "cor. of 10th St. and 5th Ave." made in 1877. I remember writing the letter offering it, but I do not recall ever having an answer, whether the Academy cared for it. However! I have it still and when I return early Nov. will get it Framed & send it or take it up. It isn't very much after all. Yet as so many of the older men lived & painted in that old "51" I thought it might help to recall the corner. The old sign on that corner as far back as I remember it, was nailed on that old forlorn tree and when I made the sketch of it had a Kite tail and the remnants of an old kite tangled in the branches, the end of the tail hanging down like a noose. A rainy dismal day,

1877

a little wet snow, & the prison van going down 10th St. to the courthouse, made a picture suited to that very dull season when few if any were paying Expenses. We have had so far the most cold cheerless Autumn for many years. Last night was a killing black frost, froze ice. The weather has driven nearly everyone away, except Inness, & he and his wife (who I don't think wishes to) are to remain up here on this mountain plateau all Winter. It is awfully lonely now. What will it be like in the depth of winter? Hope you & Mrs Maynard have had a pleasant summer & with very best wishes.

Most sincerely yours

Edw. L. Henry

The note by Henry on the painting reads: *"The old tree with the sign that stood on the corner of 5th Ave. & W. 10th St. N. Y., for over forty years." Painted in 1877 from a lead pencil sketch from nature. Wm Beard & Wm De Haas were passing at the time. The bad winter of '77, when there was very little business done & "the prison van & funerals were most of the traffic through the street," as was said by the Artists in the building at the time.*

133 A STUDY IN BLACK AND TANS
AL. p. 22
Lower right: *E L Henry '77*

The photograph in the Album is inscribed: *Exhibited in Royal Academy, 1878.* Another photograph in the Henry Collection is inscribed: *This little painting called a "Study in Black and Tans" was exhibited in the Royal Academy, London, in 1881 and hung on the line. It was painted after Nature at Concord, Pa., close to the Delaware line. The little Nigger was cutting off pieces of red flannel to decorate the collars of two "Black and Tans"*

A sketch in water color on paper, 4¼ x6¼ in., signed lower right, *E L Henry '77,* is in the collection of the Guy Mayer Gallery.

134 A QUAKER VISIT
AL. p. 26
Lower right: *E L Henry '77*
Bibliography: KL. NO. 51

1878

135 SARAH AKINS WELLS
Oil on board, 10¼ x13¼ in.
Lower right: *E L Henry, 1878*
Collection: Miss Margaret L. Wells

A portrait of Mrs Henry's grandmother. On the back it is inscribed: *Painted from life at her home in William Street, Johnstown, N. Y., summer 1878. Sarah Akin was born May 9, 1788. She was married at Sir William Johnson Hall to Nathan P. Wells Ap. 22, 1813. She died in Johnstown, Jan. 25, 1881, aged 92 years and 8 months.*

1878

136 THE DEPARTURE OF THE BRIGHTON COACH
AL. p. 12
Lower left: *E L Henry, 1878*
Exhibitions: NAD 1878, NO. 339, $600
Figure 125

137 REVERIE
AL. p. 27
Lower right: *E L Henry '78*

This painting was stolen from the gallery of the Union League Club, early in 1879, according to a newspaper clipping pasted in the Album.

138 AN AWKWARD THROW
Exhibitions: Gill, 1878

1879

139 THE PEDLER
Oil on canvas, 13⅝x19½ in.
Lower right: *E L Henry '79*
Bibliography: KL. NO. 47; illustrated in earlier edition of Klackner.
Collections: James Kirkham; James W. Kirkham; William B. Kirkham
Figure 189

140 ON THE BEACH: WAITING FOR THE BATHERS
AL. p. 17
Exhibitions: NAD 1879, NO. 198, *Waiting for the Bathers?*
Figure 47

141 A PORTRAIT OF MRS E. L. HENRY AND THE TWO BLACK AND TANS: ON THE UPPER HUDSON NEAR FORT MILLER, SUMMER OF 1879
Lower left: *E L Henry '79*

The photograph in the Henry Collection is inscribed: *This painting was stolen from the picture frame shop of late Geo. F. Of, Clinton Place, 1886.*

An inscription on the back reads: *This painting was left all summer at the frame shop of Geo. F. Of in Clinton Place and the following autumn was gone. Stolen from there during the summer. Never been able to trace it. Fortunately this photograph was taken of the painting before it was left at Mr Of's.*

141-*a* "ON THE LOOKOUT"
Pen and ink on paper, pasted on canvas, 7½x9 in.
Lower left: *E L Henry 1879*
Lower right: *E L H*
Collection: New York State Museum

142 SOUVENIRS OF LONG AGO
Bibliography: KL. NO. 60, not illustrated
Exhibitions: NAD 1879, NO. 434

1880

143 CHANGING HORSES
Oil on canvas, 16½ x31 in.
Lower left: *E L Henry, 1880*
Collections: James Ben Ali Haggin sr; Louis Terah Haggin; Eila Haggin McKee; Haggin Memorial Art Galleries, Stockton, Calif., NO. 65

144 THE BATTLE OF GERMANTOWN, PA., OCT. 4, 1777
AL. Index and p. 18
Collection: Samuel Chew, 1880–?

In 1881, Henry painted this subject for William Astor. *Cf.* NO. 161. Was it an exact copy of Chew's painting?

Cf. also reproduction, MS., pasted on back of manuscript p. 23, called *The Attack on Chew's House during the Battle of Germantown, 1777.*

An unidentified newspaper clipping in the Henry Collection writes of one of these canvases as follows:

. . . the most important he has on hand. This is the "Battle of Germantown," which, it will be remembered, was fought on the part of the British from the old Chew House, one of the most interesting of Revolutionary relics which is still standing, carefully preserved with all the marks of the dangers it passed through. As the work is historical, the artist has endeavored to make it as accurate as study of the house and grounds will permit. It is represented with windows filled with red coats, whose position has enabled them to scatter the grounds with the bodies of American soldiers who are trying to gain the house by assault. The cannon in the road has done some execution on the house, and the statuary of the grounds and the house is on fire in several places.

145 READING THE STORY OF BLUEBEARD

A photograph in the Henry Collection is inscribed on the back: *Water color. "Reading the Story of Blue Beard." E L Henry*

Figure 140

Can this be *Fairy Story,* exhibited NAD 1880, NO. 332, $125?

146 THE APPROACHING TRAIN
Bibliography: KL. NO. 12, as *The Coming Train*
Cf. MS., back of manuscript p. 16, for another reproduction.

A photograph in the Henry Collection shows the signature and date as *E L Henry, N. Y., 1880,* painted on a fence at the lower right.

147 THE WAY STATION
Bibliography: KL. NO. 80
Exhibitions: NAD 1880, NO. 182, $650

148 THE HALT AT THE FERRY
Exhibitions: NAD 1880, NO. 145
Collection: G. H. Blanchard, 1880–?

149 THE OLD TRIMBLE HOUSE, CHESTER CO., PENN: BUILT IN 1741
Exhibitions: Gill, 1880

1881

150 CAPITAL AND LABOR
Oil on canvas, 12½x15¼ in.
Lower left: *E. L. Henry '81*
Collection: New York Historical Society
Figure 56
Cf. Sketchbook 3 for drawings of a dog on a "dog churn" (Figure 59) and of a cow on a treadmill.

151 OLD HOOK MILL, EAST HAMPTON
Oil on canvas, 14x22 in.
Lower left: *E L Henry, East Hampton '81*
Collection: Mrs Francis P. Garvan sr
Figure 126
The Garvan estate owns a painting by Childe Hassam with the same title and subject.

152 THE SUMMER BOARDERS
Oil on canvas, 15x19 in.
Lower right: *E L Henry '81*
Bibliography: KL. NO. 9, as *City Boarders*
Collection: Martin E. Albert
Figure 146
The driver was a neighbor of the Henrys, Peter P. Brown. Mrs Henry is on the right and Mrs Eliza Hartshorn on the left. The buggy is coming down the old "Gully Road" from Cragsmoor to Ellenville.

153 A MOUNTAIN ROAD
AL. p. 24
Bibliography: KL. NO. 61, as *A Stony Road,* not illustrated in 1906 edition, but in earlier edition
Figure 137
The photograph in the Album is inscribed: *A Mountain Road. Shawangunk Mountains Above Ellenville,* N. Y.
The subject was identified by Sidney Terwilliger of Cragsmoor as Peter P. Brown on the old gully road. The same man and vehicle are seen in Figure 139.
The original Botsford negative envelope is inscribed: *Old Peter P. Brown on the old Gulley Road. LWB*

154 EAST HAMPTON BEACH
AL. p. 34
Lower right: *E L Henry 1881*
Exhibitions: NAD 1881, NO. 547, $1000, illustrated, 21x51.
Figure 49
A photograph in the Henry Collection, AL. p. 17 (Figure 48) shows the same subject, with slight differences. It may represent the canvas in an earlier state.
This painting or NO. 140 may be *Study at East Hampton,* sold at Ortgies sale in 1887 for $127.50, NO. 64.

1881

154-*a* BATHING HOUR, EAST HAMPTON BEACH
Pen and ink with white on bleached photograph, 4⅜ x9½ in.
Lower right: *E L Henry, 1889*
Collection: New York State Museum
Figure 50
This item was prepared for magazine reproduction and illustrates Henry's method of work. It is interesting that he altered the date of the original painting, which shows in other photographs plainly as *1881*.

155 THE MOUNTAIN STAGE
AL. p. 38
Lower right: *E L Henry '81*
Bibliography: KL. NO. 34
Figure 54
Mrs Frederick Dellenbaugh is said to be one of the passengers in the stage. *Cf.* Figure 55

156 THE RELAY
Bibliography: KL. NO. 53
Exhibitions: NAD 1881, NO. 10, $850
Figure 157

157 [REVOLUTIONARY SCENE]
AL. p. 60
A man in the costume of a Revolutionary general, an Indian chief, soldiers, sentries, are seen grouped in the doorway of a colonial house.
Cf. NO. 251

158 A WAY STATION ON A SMALL PENNSYLVANIA RAILROAD
The photograph in the Henry Collection is inscribed: *In possn of Lady Northcote, London.*

159 CHINA WAS THE PASSION OF HIS SOUL
Exhibitions: NAD 1881, NO. 445, $600

160 THE PETS
Exhibitions: Gill, 1881, "sold"

161 THE BATTLE OF GERMANTOWN
AL. p. 24
Collection: William Astor, 1881–?
Cf. NO. 144

1882

162 A HARD ROAD TO TRAVEL
Oil on canvas, 17x14 in.
Lower left: *E L Henry '82*
Collections: Dr Lawton S. Brooks; Mrs Harcourt W. Bull
Figure 139
A letter from Harcourt W. Bull jr, states that the painting was purchased by his grandfather from James D. Gill in 1884, for $205. He

1882

adds the following description: *On a partially overcast day in autumn when some colored leaves are still left, some branches are bare, on a country road running along a hillside and bordered by a split-rail fence, an old farmer drives home in an ancient topless buggy. He is moving directly away from the observer, giving a detailed view of the back of the old character seated on his buffalo robe, a red handkerchief showing from his pocket between his coat-tails, the head of a pig protruding by the dashboard at his feet. The weather-worn buggy is painted with particular care. Of especial and humorous interest are the large wheels which are just passing over a stony outcropping in the road and are each turned at a different angle.*

163 MAIN STREET, EASTHAMPTON, L. I.
AL. p. 58
Lower left center: *E L Henry '82*

164 MEETING'S OUT, ABOUT 1849
Exhibitions: NAD 1882, NO. 88, $450

165 PREPARING DINNER
Exhibitions: Gill, 1882, $225

166 A COUNTRY ROMANCE
Exhibitions: NAD 1882, NO. 454, $200

1883

167 JOHN S. BILLINGS
Oil on cardboard, 13½ x9½ in.
Lower left: *E. L. Henry*
1883
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, August 6–7, 1918
Collection: Village of Ellenville
Figure 133
A card tacked on the back is inscribed: *The late John S. Billings. An esteemed citizen of Ellenville. A lover of roses.*

"Josh" Billings lived on Center street, had a garden, loved roses, loved dramatics, used to go to New York for first nights, according to the village clerk, Miss Alice I. Moffit. Henry painted him sitting in a chair, in a dark blue suit, holding a rose in his hand. The picture is dark in key, the two notes of color being the rose and the purple velvet facing on his coat collar.

168 BRACING UP
Lower right: *E L Henry '83*
Exhibitions: NAD 1884, NO. 131, $450
Figure 138

When Mrs Thomas Wade of Cragsmoor gave the New York State Museum a sepia photograph of the subject, she spoke it as *A Quiet Nip.*

In the Henry Collection there is a sepia photogravure (plate, 8¼ x6¾ in.; paper, 17½ x13½ in.) published by the Woodbury E. Hunt Co.

1883

This is called *Going Through the Rye* and shows a different background than the above. The accompanying poem is printed on a separate, gold-edged slip of paper and tipped on to the mount.

A painting called *Bracing Up* brought $155 at the Ortgies Sale, 1887, NO. 55.

168-*a* PETER BROWN TAKING A DRINK
Pen and ink on paper, 15⅜ x11 in.
Lower right: *E L Henry '83*
Collection: Edward C. Wells, Johnstown, N. Y.

169 UNINVITED GUESTS
Lower right: *E L Henry '83*
Bibliography: KL. NO. 1, as *An Afterdinner Nap*
Exhibitions: NAD 1884, NO. 203, $650
Figure 143
A photograph in the Henry Collection is inscribed: *Large negative 18x22. Owned by C. Lambert, Patterson,* (sic) *N. J.*

170 TRAVELING SOUTH IN THE THIRTIES
Water color
Lower left: *E L Henry, 1883*
Bibliography: KL. NO. 68; Ortgies sale catalog, 1887, NO. 62, as *Traveling South Fifty Years Ago* (not sold)
In the Henry Collection there is a large photograph, 14⅞ x13⅝ in.

171 A HARD SCRAPE
Exhibitions: NAD 1883, NO. 13
Collection: Hugh Auchincloss, 1883–?

172 A LADIES RECEPTION AT THE OLD UNION LEAGUE, MADISON SQUARE
Exhibitions: NAD 1883, NO. 376, $200

173 NOVEMBER DAYS
Exhibitions: NAD 1883, NO. 215, $375

174 IN SIGHT OF HOME
Exhibitions: NAD 1883, NO. 151, $500

1884

175 IN THE ROARING FORTIES
Oil on mahogany panel, 14x21 in.
Upper left: *E L Henry '84*
Bibliography: The Story of My Life by Lucien Calvin Warner, 1914, p. 133–34
Exhibitions: NAD 1884, NO. 215, $650
Collections: Dr Lucien Calvin Warner; Mrs Seabury C. (Agnes Warner) Mastick
Figure 57

1884

There is considerable documentary material about this picture. The account book kept by Mrs Mastick's mother shows it to have been bought before January 1885, for $650. At that time, it was listed as *In The Roaring Forties*. A recapitulation, dated 1904, gives it as *In The Rolling Forties*. And by this title Doctor Warner refers to it in his autobiography.

At this time, apparently the Warners had a winnowing of their collection; for written on the back of the panel is: *L. C. Warner, Waldorf-Astoria, 2/27/04—new frame.*

A large photograph (13⅜x19¼) in the Henry Collection is inscribed on the back: *Painted by E. L. Henry about 1885. On the deck of the old White Star liner the Celtic. Four masts, three ship rig and jigger, one screw, about 13 knots.*

Cf. Sketchbook 2, NO. 1186, for two sketches related to the painting; also Figure 60.

Mrs Mastick gives the following information about the picture: *The scene is on the open deck of an Atlantic steamship of the time. The phrase "roaring forties" was used for the stormy waters off the Newfoundland Banks in the latitude of the forties. I have heard my father say that Mr Henry told him that he made the sketch on shipboard and that the members of the party sent the rugs and wraps that they wore to his studio later for him to finish the painting. Dr Warner took a fancy to this picture because it reminded him of his own first trip abroad.* [This in 1880.] *I quote from his autobiography, The Story of My Life, privately published in 1914: "We took passage on the steamer 'City of Chester' which was at that time one of the best steamers crossing the Atlantic. It was a single-screw steamer of about five thousand tons. The ventilating shafts from the kitchen and engine-room opened on the main deck, where the passengers walked and sat, so that the vile smells of the ship were constantly in evidence . . . . The only covering for the deck was canvas awnings, and these were usually removed when it rained or when the wind was high, so that in case of storm or rough weather the passengers must either endure the storm or remain in their cabins below. The painting by E. L. Henry entitled 'In The Rolling Forties' is an excellent representation of the ships of this period, and might have been taken from the decks of the 'City of Chester.'"*

Henry painted the costumes with a different color scheme than that indicated in his sketch. The first woman at the left, sitting, wears a red cloak, the second is covered with a blue, green and red plaid steamer rug, and beyond her a woman is covered with a roman striped blanket. The color is quite strong, with the seaman's red neckerchief, the blue-green water and the brown wood tones.

The color notes in the sketch are: *Scarlet hood. White border, Astrahkan. Muff, white. Gray shawl. Black skirt.*

176 MISS X AND SISTER
Oil on canvas, 20x13 in.
Lower right: *E L Henry '84*
Collection: Mrs Warren Van Kleeck

1884

177 TAKING HIS MORNING EYE-OPENER
Oil on wood, 11x7¾ in.
Signed on back: *Painted by E L Henry from life in 1884. Old Peter Paul Brown above Ellenville, N. Y., at the age of 83. Taking His Morning Eye-Opener.*
Collection: Miss Margaret L. Wells

In this version, Brown has his coat off. The two top buttons of his vest are open. He is wearing a white shirt, with a short lavender tie, untied. He is pouring something (?) from a bottle into a glass, his firm grip on bottle and glass indicating the need for an eye opener. His lips are parted (in anticipation?) and his hair is mussed. The painting shows a three-quarter length figure.

178 THE LATEST VILLAGE SCANDAL
Oil on canvas, 18x28 in.
Lower left: *E L Henry*
Exhibitions: NAD 1886, NO. 434, $500; Century Association, 1942, NO. 24
Collection: William H. Thompson

179 THE WATERING TROUGH
Lower left: *E L Henry*
Exhibitions: NAD 1884, NO. 622, $500
Figure 151

180 THE WANING OF THE YEAR
Exhibitions: Gill, 1884, $200

1885

181 THE COUNTRY STORE
Oil on canvas, 11⅝x20⅜ in.
Lower left: *E L Henry, '85*
Exhibitions: Century Association, 1942, NO. 7
Collection: Estate of Francis P. Garvan
Figure 127

182 WHAT AM DAT?
Oil on wood, 12x10 in.
Lower right: *E L Henry '85*
Collection: Gimbel's

A Negro girl in a red dress leans on her broom while she stops to talk to a Negro boy carrying a basket.

Could this be *What Dat For?*, NAD 1886, NO. 590, $225?

183 THE MAIN STREET
Exhibitions: NAD 1885, NO. 511, $350

184 FOUR O'CLOCK TEA
Exhibitions: NAD 1885, NO. 367, $375

1885

185 AMONG THE FLOWERS
Exhibitions: NAD 1885, NO. 355, $325

186 THE HOME OF THE SQUIRE
Exhibitions: NAD 1885, NO. 38, $425

1886

187 PETER BROWN
Oil on cardboard, 17½x14¼ in.
Lower right: *E L Henry*
1886
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918
Collection: Village of Ellenville
Figure 129

Peter P. Brown, the celebrated "drunk" of Cragsmoor, is shown shaving. According to Miss Alice I. Moffit, the Colgate Company asked permission from the village of Ellenville to use the picture in an advertisement. The trustees wrote Mrs Henry, then alive. She refused, saying that Mr Henry had never commercialized his art.

187-*a* PETER BROWN SHAVING
Pen and ink on paper, 7¾x6 in.
Lower right: *E L Henry*
Collection: Edward C. Wells

Inscribed on margin of paper, lower right: *Pen & Ink Drawing of old Peter Brown Shaving, 1885.*

188 MARTIN TERWILLIGER
Oil on cardboard, 13¼x9¾ in.
Lower right: *E L Henry*
Lower left: *Martin Terwilliger at the age of 95*
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918
Collection: Village of Ellenville
Figure 130

189 A COUNTRY DOCTOR
Lower right: *E L Henry '86*
Bibliography: KL. NO. 13
Figure 148

190 A VILLAGE STREET
AL. p. 38
Lower right: *E L H '86*
Bibliography: KL. NO. 72
Exhibitions: NAD 1889, NO. 341; Gill, 1890, $175?

1886

191 THANKSGIVING SLEIGH RIDE
Oil on canvas, —
Lower left: *E L Henry '86*
Figure 152
A painting of this title brought $172.50 at the Ortgies sale, 1887, NO. 67.

192 WHAT DAT FOR?
Exhibitions: NAD 1886, NO. 590, $225

1887

193 JOSEPH E. MANCE
Oil on canvas, 18x14 in.
Lower left: *E L Henry*
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918
Collection: Village of Ellenville
Figure 128
Cf. Figure 134
Joe Mance, the Cragsmoor carpenter, is shown standing, holding an L-square in his hand.
Cf. correspondence, 1884, for a letter to Henry from Mance, dated Ellenville, May 5, quoted in full in the Biographical Sketch, p. 38

194 FRED THOMAS *ALIAS* BLACK FRED
Oil on wood, 14x10 in.
Lower right: *1887, E L Henry*
Lower left: *A sketch on the Del & Hudson Canal*
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918
Collection: Village of Ellenville
Figure 131
Inscription on a card tacked on the back: *Fred Thomas alias "Black Fred." A Hunchback, Canal Boatman and Guide to the Trout Streams. Was murdered by another Negro some years ago.*
The back of the panel is inscribed similarly.

195 SHARPENING THE SAW
Oil on canvas, 16⅜x12 in.
Lower left: *E L Henry*
Exhibitions: American Genre, 1935, Whitney Museum of American Art; Century Association, 1942, NO. 51
Collection: Estate of Francis P. Garvan; New York State Historical Association
Figure 136
Is this *Learning The Trade*, sold for $115 at the Ortgies sale, 1887, NO. 53?

1887

196 **STAGE COACH**

Oil on canvas, 27x21 in.
Lower right: *E L Henry, 1887*
Collections: James Ben Ali Haggin sr; Louis Terah Haggin; Eila Haggin McKee; Haggin Memorial Art Galleries, Stockton, Calif., NO. 68

197 **THE OLD LYDIG HOUSE ON THE BRONX, NEAR FORDHAM**

A photograph in the Henry Collection is inscribed as above, with the following: *Painted from an old painting dated 1790 for the late Maria Lydig Daly.*

Figure 58

A letter from Henry to Mrs Daly gives the history of the painting, as well as throwing light on his careful method of work. It follows:

Ellenville, N. Y., July 19th '87

I would like to have a few points on the old home on the Bronx.

I was up there & made a number of drawings & studied the place & am working it out (the problem) of how it must have been 30 to 40 years ago, as numbers of the trees that I saw & have had to omit were evidently at that time not planted or very little saplings.

I wish more particulars (as it is the most prominent object) to be correct on the house. I was unable to tell from that old picture of yours whether the house was of wood, stone or stucco. If wood, was it clapboarded or boards perpendicular with battens? Also, if the end of house seen in picture had two windows side by side or but one in the middle? I have made drawing so you can mark it & return. I hope to have the picture finished by end of the month, & hope it will meet your expectations. Mrs Henry joins me in sending our love & best wishes & hope you are both having a very pleasant summer.

Very sincerely yours
EDW. L. HENRY

Cf. Figure 61 for the above-mentioned drawing, which is on the back of Henry's letter and is carried over onto a second sheet of paper. It is annotated as follows:

Was the base of the big tree on this line or line of this piazza?
Were chimneys red brick or white?
Was this the style of dormer window?
Wing from here to end?
Was this door at end of piazza a blind door or half door or did it look through a hall & window at other end? It would look very pretty in a picture.
Were there two windows parallel on this side? Or windows one above the other, only in the middle only?
If wood, what was the color of the house, red, yellow or white?

Mrs Daly replied on the back of Henry's letter, as follows: *The side of the house was common mason work, like good stone fencing of sand stone or granite grey stone and white plaster. The roof was wood shingle rounded, the rest wood boards lapping over each other, across, not up and*

1887

down. There was a small ledge forming a bench-seat about 2 feet high so that the piazza was sunken and the turf seemed to come up to the house. The old tree had pendant branches and was on a slight rise. You could see but 2 sides of house.

A letter from Mrs Daly to Henry, dated Sag Harbor, July 20th adds a few details: *I have tried to alter your drawing. There were two doors on the first side by the steps, which opened inwards and with two steps down from the piazza which made them look short. All that side was stone and whitewashed. The projection was wood and as I mention boarded, laterally, not upright. The chimneys I think were stone. I have changed the dormer windows. The steps came down quite steep. I have no doubt but that you will make a success. Bring the picture to us and stay a few days. With kindest regards to Mrs Henry.*

198 ONE HUNDRED YEARS AGO

Bibliography: KL. NO. 44

Exhibitions: NAD 1888, NO. 386, $2000; Gill, 1891, $1000, with a note that the painting was exhibited at the Paris Salon, where it received honorable mention

Figure 153

Cf. AL. p. 35, that photograph being inscribed: *Near Philadelphia. Old house, 1747*

A letter on The Art Club of Philadelphia stationery from Henry Bentley, dated November 30, 1891, reads as follows:

Friend Henry:

I am very glad we shall be able to keep your "One Hundred Years Ago" in our city and I am also pleased to know that one of my neighbors in Germantown was the purchaser. Let me hope too that you got a satisfactory price for it. It was the *picture—take it all around, on exhibition. It has been much admired and it was sure to have* [sold] *over here had not Mr. S. bought it.*

A letter from "Mr S." [E. T. Stotesbury] continued the story. It reads:

124 Tulpohocken Street
Germantown
April 9/92

Mr. E. L. Henry

Dear Sir

Some time ago I purchased at the Art Club a picture painted by you called "One Hundred Years Ago," which has been much admired as I have it in my colonial house. I want to thank you for a beautiful photograph sent me by your friend Henry Bentley, which you forwarded to him to be given the purchaser of the "One Hundred Years Ago." Should you ever visit Germantown I would be glad to have you call on me & see what an addition your picture has made to my home.

1887

199 "SCHOOL'S OUT:" BELOW CRAGSMOOR, N. Y.
Figure 147
After School, sold for $67.50 at Ortgies sale, 1887, NO. 50, may be this picture.

200 THE OLD FORGE
Bibliography: KL. 41; illustrated in earlier edition
Figure 144
Cf. NO. 234

201 GOING TO MARKET
AL. p. 47
Lower left: *E L Henry '87*
Bibliography: KL. NO. 26
A subject Henry painted with many variations. The rutted road curves from left to right over a plank bridge. At the left is a farm building, and in the distance at the right another. A man and a woman are driving away from the spectator in a single-seated spring wagon, drawn by a white and a dark horse. The woman is holding an umbrella.
Is this *On the Way to Market,* Gill, 1891, $300?

202 THE OLD TOLL GATE
Bibliography: KL. NO. 66
Exhibitions: NAD 1887, NO. 324

1888

203 COMING FROM CHURCH
Oil on canvas, 22x16 in.
Lower left: *E L Henry '88*
Bibliography: KL. NO. 10
Collections: Daniel Graham; Mrs Charles B. Knox
The man driving is Mr Graham's great-grandfather, James C. Kennedy. With him are his wife, Lucinda Grinnell Kennedy, and a friend. They are on their way home from the West Galway, N. Y., church.

203-*a* COMING HOME FROM CHURCH
Oil on academy board, 14x11 in.
Lower left: *E L Henry*
Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918
Collections: Mrs George Deyo; Mrs Barbara Deyo Bealer
A letter from Mrs Lilah Deyo Johnson of Ellenville, Mrs Bealer's aunt, states: *The scene depicts people leaving a country church. The time is autumn. In far background are horses and carriage, and man and woman on ground. Then coming down road a team of bay horses; four in wagon, man driving and three women. In foreground a single rig with white horse, elderly man having gray beard, driving, two older women in bonnets and shawls, one on either side of driver. This rig is passing a little girl and boy, walking on road. My niece states she has been told this girl was named*

1888

Grace Keir, who lived at Cragsmoor. This painting was one of many exhibited in Ellenville, as a benefit for Red Cross, during the World War. Many Cragsmoor artists loaned and had for sale some of their work. Mr George Inness jr, stated this picture differed from some of Mr Henry's work in that it showed greater distance, and the lighting raised from some of his others.

In a second letter, Mrs Johnson adds the information that the picture was purchased by her brother, George Deyo, as a present for his wife, and that at her death it went to their daughter, Mrs Bealer.

Cf. McCausland, '41, p. 54–55, '57, 95–96, for further information on the Red Cross benefit exhibition.

204 [TAKING A REST]
Oil on canvas, 17x12½ in.
Collection: New York State Museum
Figure 124

205 KEPT IN: A STUDY IN A COUNTRY SCHOOL
AL. p. 38
Figure 141

206 THE MAIL STAGE ON THE MOUNTAIN
AL. p. 60

A photograph in the Henry Collection is inscribed: *Painted about 1888. Owned by Mrs Willis A. Barnes, 446 Central Park West, N. Y.*

207 COMING FROM THE TRAIN
AL. p. 62
Lower right: *E L Henry*
Bibliography: KL. NO. 11

A man and a woman are driving toward the spectator, with a child seated between them. The woman holds an umbrella. The buckboard is drawn by two dark horses and is about to cross a plank bridge over a rivulet. The road is lined on either side with rail fences. At the left in the distance is a farmhouse.

208 FORGOTTEN
AL. p. 27
Lower left: *E L Henry '88*
Figure 253

From the photograph in the Henry Collection this seems to be a water color. It is inscribed on the back: *"Forgotten." Owned in St. Paul, Minn.*

209 [MRS HENRY IN A BUCKBOARD]
AL. p. 32

210 VACATION TIME
AL. p. 62

211 [A PAUSE]
AL. p. 19

A couple on horseback have stopped to talk to a clergyman in a carriage.

1888

212 A TEMPERANCE PREACHER

Lower left: *E L Henry '88*

Bibliography: KL. NO. 64

Exhibitions: Possibly NAD 1888, NO. 78, $375, as *Layin' Down De Law*

Figure 154

Cf. AL. p. 47, inscribed *Scene in Georgia;* also manuscript p. 22 MS., for pencil sketch and reproduction

213 A VENDER OF SIMPLES

AL. p. 58

Exhibitions: Gill, 1890, $175

An unidentified newspaper clipping refers to this picture as follows: *Among the figure pieces one of especial merit is Edward L. Henry's "Vender of Simples," which is not only a delightful character picture, and one of the best things Mr Henry has ever painted, but preserves for history a characteristic southern scene. The original village square which forms the scene and background of the picture must be in Virginia, and all its rustic traits are attractive; while the old chap in the front who at his board awaits customers for garden sauce is a quaint and original person, whom one would like to meet and chat with.*

It is more likely that the scene of the painting is Tennessee; for the Henrys traveled there in 1888.

214 SMOKY MOUNTAINS, N. C.

Bibliography: KL. NO. 59

A photograph in the Henry Collection is inscribed on the back: *"On the Way to Market" A Study in the great Smoky Mts. of North Carolina on the border of East Tennessee. Owned in N. Y.*

215 STREET SCENE, KNOXVILLE, TENN.

Bibliography: KL. NO. 62

216 [FAMILY PARTY]

AL. p. 46

A Negro family is sitting in the yard behind a Southern mansion. The younger man is playing a guitar. Through a rustic covered gate a woman in white may be seen in a garden. In the foreground there is a square wooden pump.

217 [SOUTHERN SCENE]

AL. p. 35

Three men in shirt sleeves and slouch hats are sitting in front of a building which cannot be identified, though there is a sign which reads *House* in front of it. An ox cart and oxen are standing in the street, and a dog looks on. The types are related to other Southern subjects, and the ox cart is like that in NOS. 212 and 214

218 [A CLEAN SWEEP]

AL. p. 35

Lower right: *E L Henry*

A Negro maid sweeping the porch has been interrupted by some comic incident not clear in the picture and leans on her broom to laugh. She is wearing a white apron and a hat. A drove of hogs may be seen coming down the street.

1889

219 ON THE RONDOUT

Oil on canvas, 11½x15½ in.
Lower right: *E L Henry 1889*
Exhibitions: Century Association, 1942, NO. 40
Collection: James Graham and Sons

Inscribed on back: *A sketch from nature on the Rondout above Napanoch, N. Y., the Shawangunk Mountains in the distance. This is just below the celebrated "Yama Nouchi Farm." E L Henry 1889*

220 THE VILLAGE STREET

Lower right: *E L Henry '89*
Bibliography: KL. NO. 72
Exhibitions: NAD 1889, NO. 341, $175

221 [BACKDOOR CONVERSATION]

AL. p. 62
Lower left: *E L Henry*

Two women are talking at a farmhouse back door. The architecture is faintly southern. But the women are reminiscent of those Henry painted around Cragsmoor.

222 A LOVER OF OLD CHINA

Lower right: *E L Henry '89*

A photograph in the Henry Collection is inscribed on the back: *Finding rare examples in the old lady's cupboard. The gentleman in this picture was Mr Richard Ely, cor. 5th Ave & 35th St, and who was attache of Legation at court of Louis Phillipe, 1839–40 & 41. The old lady was Mrs Livingston Murray (Mrs Henry's aunt) & who lived to nearly 101 years of age. Painted by E. L. Henry, in 1886–8.*

223 BOUND TO CUT A SHINE

AL. p. 57, 60
Exhibitions: NAD 1889, NO. 316, $375; Gill, 1890, as *Bound to Shine,* $300

The unidentified newspaper clipping quoted under *A Vendor of Simples,* No 213, refers to this painting also, as follows: *Mr Henry also illustrates Negro life in "Bound to Shine," with the belle posing before the glass, the little sister admiringly grinning, and outside the expectant beau leaning against the fence with his hands in his pockets, waiting for the appearance of his charmer.*

224 IN DOUBT

AL. p. 57
Exhibitions: NAD 1889, NO. 43, $300

225 [YOUNG MERCHANTS]

AL. p. 58
Lower left: *E L Henry*

226 [NEGRO GIRL RINGING DOORBELL]

AL. p. 62

1889

227 A QUIET LITTLE COUNTRY WEDDING

A photograph in the Henry Collection gives the title as above.

228 A CALL ON THE BRIDE

Exhibitions: Gill, First Annual Water Color Exhibition, 1889, $250

229 THE COUNTRY STAGE

Exhibitions: Gill, 1889, $450

1890

230 NELLY BLOOMER

Oil on wood, 18½x15 in.

Upper right: *E L H, Sept. 1890*

Lower left: *Aunt Nelly Bloomer*

Exhibitions: Art Exhibition for the Benefit of the Red Cross, Hunt Memorial Hall, Ellenville, N. Y., August 6–7, 1918

Collection: Village of Ellenville

Figure 132

A card tacked on the frame reads: *Aunt Nelly Bloomer. Painted from life on her 100th birthday. She lived to the great age of 103.*

Tacked on the back of the panel is a card, reading: *Mrs Nelly Bloomer of Ellenville. Painted from life on her 100th birthday. She lived to 103 years. E. L. Henry, 1890.* The story goes that Henry read in the local papers that she was to celebrate her hundredth birthday. He went to call, with a bouquet of flowers, and began then and there to paint the portrait. She is shown wearing a gray dress, with lace cap and fichu and old steel spectacles. She sits in a rocking chair with an antimacassar.

Aunt Nelly Bloomer's home was at the corner of Canal and Bloomer Streets, the latter named for her family.

Cf. Loose Notes (CAT. 1213) for sketch inscribed *Aunt Nelly Bloomer at 95. 1885. Sept. 10.*

231 A VIRGINIA WEDDING

Oil on canvas, 21¼x36 in.

Lower right: *E L Henry, N.A. '90*

Bibliography: KL. NO. 74

Exhibitions: Century Association, 1942, NO. 56

Collection: Estate of Francis P. Garvan

Figure 155

The occasion of this painting was the marriage of Elizabeth Otis Woodruff to Edward Carroll of Charleston in the '80s. The horses were painted from the gray team of Doctor Woodruff of Pine Bush, N. Y., Jennie being on the left and Major on the right.

Robert McIntyre of Macbeth Galleries bought the painting from James D. Gill of Springfield and sold it to the Garvan Estate. An unidentified newspaper clipping pasted on manuscript p. 41, MS., reads as follows:

Perhaps Mr Henry is best known by his pictures of the period following the Revolution, during the latter part of the 18th and the early part of

1890

the 19th centuries. He has made a special study of the costumes, the architecture, the decoration, the carriages, the manner of life of the well-to-do classes in this country, both North and South, during that time, and he loves the picturesqueness, the color, the vivacity by which it is characterized. His Virginia Wedding, with its gay crowd on the veranda of a colonial mansion, the carriage at the door, and all the happy excitement so well indicated in faces and gestures, is a good example of this phase of Mr Henry's art.

232 A COUNTRY SCHOOL
Oil on board, 11⅞x16⅞ in.
Lower left: *E L Henry, N.A. '90*
Bibliography: KL. NO. 15; *Life in America*, 1939, pl. 147
Exhibitions: NAD 1891, NO. 264, as *The Class in Second Reader;* Life in America, Metropolitan Museum of Art, 1939; Century Association, 1942, NO. 7
Collection: Estate of Francis P. Garvan
Figure 149
Cf. NO. 241

233 COUNTRY SCENE
Oil on canvas, 12x22 in.
Lower left: *E L Henry*
Collection: Estate of Francis P. Garvan
Figure 66

The scene shows barns and a house, apple trees and in the distance the familiar mountains of the Cragsmoor country.
Cf. Figures 64 and 65

234 THE COUNTRY CARPENTER
Lower left: *E L Henry 1890*
Figure 145

The photograph in the Henry Collection is inscribed: *Painted after nature in the early "eighties" at Cragsmoor, N. Y.*
Cf. Figures 128, 134 and 144

235 A SITTING ROOM IN HOLLAND

One photograph in the Henry Collection is inscribed on the front of the mount: *E L Henry, 1889*, and on the back: *Mrs Judge Bookstaver, posed for this figure and it was a fine likeness and Judge Bookstaver bought the picture.*

Another photograph is inscribed on the back: *Mrs Bookstaver, widow of Judge Bookstaver, in early Dutch dress. Painted for the Judge. Painted in 1890. An old Holland Dutch interior.*

236 THE DEPARTURE OF THE BRIDE
AL. p. 57
Bibliography: KL. NO. 21

A photograph in the Henry Collection is inscribed: *Left by Mrs Wilcox of Brooklyn. Now at Westerly Memorial Hall, R. I.*

1890

237 ON THE WAY TO TOWN
AL. p. 52
Exhibitions: Probably NAD 1891, NO. 149

The same man and woman and wagon as are seen in NO. 201 appear in this painting. The horses are both dark now, however. A farm girl in sunbonnet is walking beside the road, barefooted. The woman still holds her umbrella, and the equipage is still driving away from the spectator.

238 [STOPPING TO TALK]
AL. p. 58

A couple in a buckboard drawn by two dark horses has stopped to talk to a farm girl in sunbonnet leaning over the fence. This subject differs from NOS. 201 and 237 in that the two have a child on the seat between them, and the woman does not hold an umbrella.

239 [SWAPPING NEWS]
AL. p. 58

A man in a buckboard with a robe draped over the seat has stopped to talk to a neighbor. He has his back turned to the spectator but has pivoted around to talk to the other man who faces out of the picture. The scene is a typical one on the "mountain" at Cragsmoor, N. Y.

240 STUDYING HER SUNDAY SCHOOL LESSON

The photograph in the Henry Collection is inscribed: *Studying her Sunday School lesson and fell asleep. A study from life by E L Henry.*

241 THE NEW SCHOLAR
AL. p. 17, p. 27

A photograph in the Henry Collection is inscribed: *Owned by Wm Alker.*
Cf. NO. 232

242 AT THE TOLL GATE
AL. p. 46

The painting shows the Evanses in a buckboard at the toll gate, in a view from the opposite side shown in KL. NO. 66.

243 A SUMMER DAY
Exhibitions: NAD 1890, NO. 263

244 A MOMENT OF PERIL
Exhibitions: NAD 1890, NO. 479

Is this *A Moment of Terror,* KL. NO. 32?

245 TOWARD EVENING
AL. p. 58

1891

246 THE COUNTY FAIR

AL. p. 60

Bibliography: KL. NO. 17; Sun and Shade, 1891–2, v. 4

Exhibitions: World's Columbian Exposition, Chicago, 1893, Fine Arts Building, NO. 550, as *The Country Fair*

Collection: W. F. Havemeyer, 1893–

Figure 182

The photograph in the Album is inscribed: *From the picture in the possession of W. F. Havemeyer* and is dated *April, 1891.* The scene is at the Ulster County Fair, and Nancy Evans of Walker Valley, N. Y., was the model for the woman.

247 ON THE OLD GULLY ROAD ABOVE ELLENVILLE

AL. p. 60

Figure 245

A photograph in the Henry Collection is inscribed on the back: *The painting was purchased by Andrew Carnegie & is now in Skibbo Castle in Scotland. He purchased it to show some of the awful roads in the Eastern States.*

Cf. Figures 137 and 139

248 VILLAGE POST OFFICE

AL. p. 54

Bibliography: KL. NO. 71

Figure 62

A photograph in the Henry Collection is inscribed on the back: *Collection of Shepard Knapp.* Another photograph is inscribed: *The Main Street*

Florence T. Taylor, Ellenville librarian, states that there is no reason to believe the old Low store was ever the post office. This store is still standing at the corner of Canal street and Cape road. Formerly owned by Jesse Low, it is now owned by David Harkavy.

Cf. Figure 63

249 THE TOW PATH

AL. p. 52

Bibliography: KL. NO. 67

Exhibitions: Gill, 1893, as *The Delaware Canal,* $400

Figure 170

A photograph in the Henry Collection is inscribed on the back: *Now in possession of G. G. Stow, White Plains.*

Leon Sciaky in New York History, July 1941, gives a good account of the Delaware and Hudson canal, which appears in many of Henry's paintings of this period. The canal, to be a tidewater route from mine to city, was begun in July 1825, and opened for business in October 1828. It was 28 feet wide at the top, 20 at the bottom, with a maximum depth of 4 feet. At first it accommodated only barges up to 30 T. The distance from Eddyville (on the Hudson near Kingston) to Honesdale, Pa., was 108 miles, with another 16 miles by rail to Carbondale.

1891

The first barge to navigate the canal was the Orange Packet. By 1832, there was a traffic of 4000 tons a month. In 1836 a flagstone industry developed in this region, due to the cheap transportation. Twice the canal was enlarged, till it reached a maximum capacity of 136 T. per boat. By 1872, a million tons of cargo were being carried by canal to tidewater. The flood of December 1878 caused serious damage. But the greatest harm was caused by the rise of rail transport. On November 5, 1898, Boat No. 1107 cleared Honesdale with the last load of anthracite. A transportation era had ended. (*Cf.* also McCausland, '41, p. 4–5, 46, 59–61, 155.) Henry did not seem to concern himself with this aspect of the D & H canal. It was its picturesque quality he put down on canvas. Rarely a subject like Fred Thomas (NO. 194 and FIG. 131) portrayed the realistic side of canal life. Usually it was the visual sentimental image Henry set forth.

An unidentified newspaper clipping, probably from the Ellenville Journal or Press, adds further data. It reads:

Last Trip on Old Canal

Edward Murtha of New York was last week visiting friends in Honesdale, and talking about bygones he said that he drove the horses that drew the last load of pea coal out of Honesdale. That was on Saturday, November 5, 1898; the name of the boat was "Sunshine," and her number 1107. Frank Hinzenbecker, of 49, German street, Kingston, captained the barge on this farewell trip.

That was thirteen years ago. A glance at the line of the old canal along the valley suggests that it must have been much longer ago. The Honesdale Citizen, which contains this note, recalls that the canal was built in 1828, eighty-three years ago; cost more than six millions of dollars, and was in operation almost 71 years, then in 1899 sold to the Erie R. R. Company.

More information is supplied by an unidentified newspaper clipping, probably from one of the Ellenville papers, inscribed by Henry: *The last of the "breaks" in the old Del & Hudson Canal—Now in use for a few weeks only, prior to its being filled up for the R. R.* It reads:

A bad break occurred in the canal on the level below Kerhonkson, Thursday afternoon, the fourth, occasioning much inconvenience to Cox Bros., and other shippers of wood, &c., whose time for boating is now very short. The leak started near the aqueduct, the origin being unknown—very possibly the work of a muskrat, or something of the sort.

The break took away some thirty or forty feet of the canal bank, and tore out the bottom for a good stretch to the depth of ten or a dozen feet below the canal bottom. Sup't Rose at once organized a force for repair, and fifty or more men, with teams, piled in stonewall and earth from a neighboring field into the gap, and it was a scene of genuine hustling up to Tuesday, when water was put in, but a leak necessitated further work. Thursday afternoon the water was let in, and the waiting boats were started down.

1891

250 [AT THE LOCKS]

AL. p. 19

Another scene on the Delaware and Hudson canal. It shows a packet boat towed by two horses, approaching the locks. Men and women in gay costumes of the early part of the 19th century sit on the flat top of the packet boat and observe the country landscape.

251 [CONFERENCE]

AL. p. 19

Another revolutionary scene. (*Cf.* NO. 157) Sentries stand outside a mansion, through whose open door uniformed men may be seen sitting at a table in earnest discussion.

252 THE GOLDEN HOUR

Exhibitions: NAD 1891, NO. 392

1892

253 THE NEW WOMAN

Bibliography: KL. NO. 37

Figure 179

A photograph in the Henry Collection is inscribed on the back: *The Bicycle Girl. Quite common, 15 to 20 years ago. From a sketch from nature above Ellenville, 1892.*

Cf. McCausland, '41, p. 193–94

A letter from May A. Bookstaver, dated October 22, 1896, refers to this painting. It reads as follows:

Pembroke West,
Bryn Mawr,
Pennsylvania.

Dear Mr Henry:

If it were not for that demon of procrastination which possesses me, you would have known long ago how much I enjoyed your letter and the newspaper clippings you so kindly sent me.

Judge McLean should I think be greatly complimented on having had the courage of his convictions. I hope the women will prove themselves capable for that would encourage me more than anything else to take steps toward accomplishing what is still my ambition.

I am glad that you have so few Bryanites in your part of the country. I wish we could say the same here. This is the only part of Pennsylvania, I believe, which is not solid for McKinley, but here we have numerous expressions of free silver ideas. I am going to a political meeting tonight in the Town Hall, where both sides of the question are to be discussed. What do you think the upshot of such an arrangement will be, a free fight?

It is certainly very kind of Mrs Henry to think of sending us apples. I am sure they will be greatly appreciated at home. Things edible always are.

Mrs Henry and yourself will not forget to come and see me, will you when you come to Philadelphia? I can promise you material for numberless caricatures, for women when they go all to brain do very strange things. I saw a long article about that bicycle picture of yours the other day. It seems to have been fully appreciated.

This sounds like another new woman.

1892

254 TESTING HIS AGE

Bibliography: KL. NO. 65

Exhibitions: NAD 1892, NO. 418, as *Proving His Age*

Figure 192

A photograph in the Henry Collection is inscribed on the back as above and on the front as: *Holding him uncomfortably by the under lip.*

Charles Peters of Cragsmoor has a letter from Oliver H. Durrell of Boston, Mass., dated March 16, 1899, to Henry, at 111 East 25th street, New York, to the effect that he was sorry the painting had been sold and wanted to know what Henry would paint a similar subject for in oil. The painting would be only for his private collection and would never go on the market. He referred to the painting as *Making a Trade*, a water color.

The scene is in front of the old Mance house on the mountain at Cragsmoor. Later the house was owned by the Coddingtons. The Evanses of Walker Valley serve as models again.

Cf. McCausland '41, p. 224

254-*a* TESTING HIS AGE

Pencil on paper, 14⅞ x10⅞ in.

Collection: New York State Museum

Figure 195

255 MEDITATING REVENGE

AL, p. 56

Exhibitions: NAD 1893, NO. 296, $200

Figure 142

256 AFTER THE SHOWER

Exhibitions: NAD 1892, NO. 236

Could this be KL. NO. 2, *After the Rain?*

A water color of this title was sold at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916 for $62.50. The catalog describes it as follows: *Stage coach leaving the Tavern. Signed with initials.*

1893

257 THE FIRST RAILWAY TRAIN ON THE MOHAWK AND HUDSON ROAD

Oil on canvas, 42¾ x110 in.

Lower left: *Copyrighted*

E L Henry 1892–3

Bibliography: KL. NO. 23, as *The First Railway Train*

Exhibitions: World's Columbian Exposition, Chicago, 1893, Transportation Building; Corcoran, 1894; NAD 1894, NO. 377, as *The Opening of the First Railroad in New York State, August, 1831, between Albany and Schenectady;* Universal Exposition, St Louis, 1904, special medal

Collection: Albany Institute of History and Art, Albany, N. Y.

Figure 162

Note that the signpost in the painting reads: *To Schenectady 15 miles To Albany 2 miles.* The locomotive is inscribed: *Mohawk & Hudson R.R. Co.*

1893

Cf. MS. p. 330*ff.*

Martin E. Albert, himself the owner of a number of Henrys, reports that Mrs Henry told him Henry received $15,000 for the painting. Mr Albert posed for some of the figures, namely, the man running and a man sitting in a coach.

There is considerable correspondence about the painting in the files of the Henry Collection, including a note from the Quaker William Kite of Germantown about the first locomotive; letters between Henry and J. C. Pangborn of the Baltimore and Ohio about shipping the canvas to Chicago etc.; a request from F. E. Stebbins of the U. S. Patent Office for a photograph of the picture; a letter to Henry from Tiffany's regarding using the railroad painting on a "Transportation Vase," and letters from John S. Kennedy and W. F. Havemeyer about the possible purchase of the painting by the Metropolitan Museum of Art.

The Mohawk and Hudson Rail Road Company was chartered April 17, 1826, but took four years to raise capital of $300,000. Construction began August 1, 1830. *For thirteen years* (writes the New York Times of April 11, 1926) *horses drew the cars from the tollhouse in Albany to the first incline, up which the trains were drawn by ropes. Then the locomotive hauled the cars over twelve miles of level and straight road to the Schenectady incline, from whose foot horses pulled the train to the Schenectady tollhouse.*

The railroad's official opening was on September 24, 1831. But a trial trip for passengers was made on August 9—free for those who dared attempt it. The DeWitt Clinton engine, built at the West Point Foundry, supplied power. Concord coaches with special wheels to fit the rails were hitched on. The locomotive belched forth smoke and fire, and the passengers had to put out the flames. Frightened horses ran away. All in all, an historic occasion, and a good theme for Henry's anecdotal gift.

A loose, unnumbered sheet in the MS. gives more information:

THE OPENING OF THE FIRST RAILROAD TRAIN IN N. Y. STATE AND THE SECOND IN AMERICA AS A PASSENGER ROAD SEPT. 1831

The start was made at the two mile level, at the junction of Lydias Street and the Western Turnpike, and ran from Albany to the top of the hill at Schenectady. The train consisted of three cars, stage coach bodies, supported on trucks, and were drawn by the "little" De Witt Clinton, built at the West Point Iron Foundry, and were followed by several platform cars drawn by horses driven tandem.

Large crowds collected from the surrounding country, attracted by this novel sight, or event.

The roadbed was supported on square stone blocks, on which were laid pine timbers, with half-inch iron bars nailed on as rails. No brakes were used on these experimental trips, and the sudden jerk in starting, and violent bumping in stopping was so serious, that at the first water station, fence rails were strapped on between each car, thus keeping them apart.

On this trial trip, those seated on top, particularly the two back coaches, suffered from the sparks from the engine pipe, burning holes in their

1893

umbrellas and clothes. The conductor sat on a small "gig seat" at the end of the tender and gave the signal for starting and stopping by blowing through a tin horn.

The engine was built on the idea of a coach horse, lightness with strength and of course failed in traction, particularly in wet weather, when, according to their advertisements, horse power was substituted.

This was the first R R built and equipped for passenger service in America, with the exception perhaps of an experimental one, between Charleston and Hamburg in South Carolina the year previous.

A note added on the back reads:

The first train run as a passenger train in America was from Charleston to Hamburg, S. C., built in 1830. The engine was built at West Point Foundry, where the DeWitt Clinton was built. It blew up after running for three months. After that horses were used. The engine was called the Best Friend.

257-*a* THE FIRST RAILWAY TRAIN

An entry under the heading, *Water Colors by E. L. Henry,* in the catalog for the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916 gives the above title as having sold for $125. The description reads: [*Hudson and Mohawk R.R.*] *Sept. 9th 1831. From the painting by E. L. Henry. Colored. 14x38.8 in.*

The photogravure, advertised in Klackner as 13¾x34¾, sold for $10 plain and $15 colored. The difference in dimensions suggests, however, that the picture sold was not necessarily a colored print, in spite of the catalog's description, but a smaller version of the large painting.

258 THE COACHING PARTY

Oil on canvas, 18x14 in.
Lower left: *E L Henry, 1893*
Collection: Albany Institute of History and Art

259 IN THE RONDOUT VALLEY

Exhibitions: NAD 1893, NO. 322, $200; Gill, 1894, $150

May this be one of the Henry paintings, of the same title, shown at the Red Cross benefit exhibition in Ellenville, in 1918? *Cf.* McCausland, '41, p. 54–55, 95

260 NOON TIME

Exhibitions: NAD 1893, NO. 238, $85

1894

261 LATE AFTERNOON ON THE OLD DELAWARE AND HUDSON CANAL, AT PORT BEN, N. Y.

Oil on board, 7½x9½ in.
Exhibitions: Century Association, 1942, NO. 23
Collections: Thomas B. Clarke; Mabel Brady Garvan Collection, Yale University Art Gallery
Figure 171

1894

A slip of paper pasted on the back of the painting reads:

A study of a late afternoon effect at a canal lock on the old Del & Hud Canal at "Port Ben," Ulster Co., N. Y., The spire of a church in the distance is at Ellenville, a few miles back.

The characters in the picture were residents of that locality and posed for me. The painting was sold at a private exhibition at the Century Club to Mr Thomas B. Clarke and was afterwards in the sale of his noted collection.

E L HENRY, N.A.

262 ENTRANCE TO HENRY HOUSE, CRAGSMOOR, N. Y.
Oil on board, 7¾ x9¼ in.
Lower left: *E L Henry 1894*
Collection: Miss Margaret L. Wells
The painting is inscribed on the back: *To F L H, for her birthday June 25, 1894, with love of E L H—pinxit.* The painting shows the rustic gateway leading into the Henry grounds, now renamed The Hemlocks by the present owners, Mr and Mrs R. L. Foster.

262-*a* E. L. HENRY'S HOME AT CRAGSMOOR, N. Y.
Oil on board, 7¾ x9¼ in.
Lower left: — *June 25, 1914*
Collection: Edward C. Wells, Johnstown, N. Y.
Inscribed: *A Present to Frankie on her Birthday, June 25th, 1914, painted for her by her husband, E. L. Henry, N.A.*

263 [NEWS OFFICE]
Oil on canvas, 4¼ x6¼ in.
Lower left: *E L Henry*
Collection: James Graham and Sons
Figure 183
Cf. NO. 343
The mat is inscribed: *To Hon^bl Henry W. Bookstaver with comp^lts of E. L. Henry. April 1894.*

1895

264 A COUNTRY LAWYER
Lower left: *E L Henry '95*
Bibliography: KL. NO. 14
Exhibitions: NAD 1895, NO. 200, $450, as *Asking Legal Advice,* illustrated 18x23
Figure 150
The country lawyer is George Keeler of Ellenville and his client is Peter P. Brown, ubiquitous in Henry's paintings of this period.

265 [AN INFORMAL CALL]
Lower right: *E L Henry 1895*
The photograph in the Henry Collection shows an old man and woman in a buggy drawn by a single dark horse, talking to a couple outside their

1895

farmhouse. The man is seated on a sawhorse, and the woman wearing a sunbonnet stands, her back to the spectator, with her hands on her hips. In the distance the familiar Cragsmoor mountains may be seen, with the characteristic rail fence also in view. May this be *On the Way Home,* exhibited NAD 1896, NO. 95, $500, illustrated 19x30?

266 [RALPH MANCE AS MESSENGER]
AL. p. 48
Ralph Mance of Cragsmoor is carrying a basket. He is five years old. Mrs Bertha Mance Peters of Cragsmoor, his sister, has a photograph of the subject taken by Henry, evidently as a model for the painting.

267 GETTING READY FOR MARKET
Lower right: *E L Henry '95*
Bibliography: KL. NO. 25

268 THE VILLAGE STREET
Exhibitions: NAD 1895, NO. 183, $200

269 THE VILLAGE SQUIRE ENTERTAINING THE NEW DOMINIE
Exhibitions: NAD 1895, NO. 195, $500

1896

270 MRS NANCY EVANS
Oil on panel, 8x6 in.
Exhibitions: Century Association, 1942, NO. 30
Collection: Harry MacNeill Bland
Figure 135
The panel is inscribed on the back: *Painted from life, Walker Valley, Ulster County, N. Y., 1896.*

271 THE SWEETEST FRUIT
Oil on canvas, 11½x15½ in.
Lower left: *E L Henry '96*
Collection: Bernard H. Cone
Two white boys and two Negro boys are stealing water melons and running for it. An old Negro and his dog are coming out of the cornfield in pursuit of the marauders.

272 NEWS OF THE NOMINATION
Oil on canvas, 17x28½ in.
Lower left: *E L Henry*
Bibliography: KL. NO. 36
Exhibitions: NAD 1897, NO. 143; *Century Association,* 1942, NO. 31
Collection: Milch Galleries
The painting shows a man in a buggy which sags under his weight as he leans to the right to talk to two farmers. One of them is sitting on the rail fence, the other leans on it. Both wear work clothes and seem glad of a breathing spell. A scythe is hooked over the top rail of the fence.

1896

273 MORNING PRAYERS: A STUDY AT A POOR FARMER'S HOME IN ULSTER CO., N. Y.
Lower right: *E L Henry '96*
Another photograph in the Henry Collection is inscribed: *Reading the Bible before breakfast. Old Oliver Evans and wife, Walker Valley, N. Y.*

274 A VIRGINIA POST OFFICE
Bibliography: KL. NO. 73

275 BIDDING GOOD BYE
Lower left: *E L Henry '96*

276 "GOOD-BYE"
Exhibitions: NAD 1896, NO. 346, $180; Gill, 1897, $175

277 WAITING FOR THE FERRYMAN: TIME, ABOUT 1844
Exhibitions: NAD 1896, NO. 230, $275

278 WAITING FOR THE FERRY
Lower left: *E L Henry*
Bibliography: KL. NO. 76

279 ON THE WAY HOME
Exhibitions: NAD 1896, NO. 95, $500, illustrated 19x30; possibly, Gill, 1907, $450
Could this be KL. NO. 55, *Returning Home?*

1897

280 [NEAPOLITAN SCENE]
A photograph in the Henry Collection is inscribed on the back: *Painted for Peter Doelger, 1897.*
The painting shows a scene along the waterfront with Vesuvius in the background, smoking. A two-wheeled vehicle drawn by a horse with a plume in its harness is filled to overflowing with driver, a woman holding a baby, a priest, three men sitting at their feet and three other men hanging on behind. Typical architecture is seen at the left, and to the right there is a flirtation going on.

281 THE CHILDHOOD OF RAPID TRANSIT
Lower left: *E L Henry '97*
Bibliography: KL. NO. 8
Exhibitions: NAD 1897, NO. 309, illustrated 16x33, as *In 1837—The Childhood of Rapid Transit;* Gill, 1913, $1200

282 THE PILLORY AND WHIPPING POST, NEW CASTLE, DELAWARE
Bibliography: KL. NO. 20, as *A Delaware Whipping Post*
Exhibitions: NAD 1897, NO. 140
Collection: Fred G. Kraft

1898

283 SUNDAY MORNING (OLD CHURCH AT BRUYNSWICK)

Oil on canvas, 34x62 in.

Lower left: *E L Henry, 1898*

Bibliography: NAD catalog, 1898, NO. 205, illustrated 34x62; KL. NO. 39, as *The Old Dutch Church, Bruynswick, N. Y.*

Exhibitions: NAD 1898, NO. 205

Collections: John G. Myers; Mrs George P. Hilton; J. G. Myers Hilton.

Figure 67

Cf. MS. p. 331, 333*ff.;* also McCausland, '41, p. 29–31, 68; also Figures 68, 69 and 70

The story of this painting is interesting. It was originally purchased by John G. Myers of Albany from the artist; he was the grandfather of the present owner. The painting was inherited by his daughter, Mrs George P. Hilton (Jessie Kenyon Myers) and bequeathed by her to her son, J. G. Myers Hilton. On her death, Mr Hilton lent the painting to his aunt, Mrs H. King Sturdee, Taunton Manor, England, for her lifetime. The painting came back to the United States about a dozen years ago. There was considerable difficulty in getting it out of England without paying death duties. In the course of all these travels. the key to the identity of the people in the painting was lost. The painting was cleaned by David C. Lithgow of Albany and is now under glass. (McCausland, '41, p. 196–201.) Mrs Hilton, in giving the above facts, added that the yellow house in the background was taken from an old house in Johnstown, N. Y. Mrs Lawrence Stetson of Johnstown states that the house was the Gilbert house on South William street, built by Judge Morrell, no longer in existence.

Miss Mary Hartshorn Woodruff of Nyack, N. Y., a cousin of Mrs Henry, added another chapter to the history. (McCausland, '41, p. 232–36.) The Henrys were staying with the Woodruffs in Pine Bush. Miss Woodruff could drive a horse, so the three of them went in a double-seated carriage on the five-mile drive to Bruynswick. Henry painted all day, just stopping while they ate their picnic lunch in the carriage house.

In regard to the fact that the church actually has five columns, though Henry painted it with but four, Miss Woodruff contributed a footnote. Henry said he knew antiques. All the time he was painting, he fussed, blustered and flustered, saying no church could be built that way; this, in spite of the fact that the Bruynswick Church obviously *was* built that way. So the church appeared in the painting edited and censored.

The final anecdote from Miss Woodruff tells of the sale of the picture. Walter L. Palmer, son of the Albany sculptor, was in Henry's studio, in New York, and saw the painting. John G. Myers, the Albany merchant, was hunting for a painting to celebrate his wife's return from a trip. He had built a new house and there was a large space in the hall for which he wanted a picture. Palmer told him of the large Henry canvas he had seen, and Myers bought it forthright. When his wife came home and entered the hall, she exclaimed "Where did you get that picture of that church?" As a little girl, she had visited cousins nearby and had attended it every Sunday.

1898

An unidentified clipping in the Henry Collection reads:

ACADEMY OF DESIGN

The Spring Exhibition

Academy exhibitions generally contain a good proportion of subject pictures, and the present display is no exception to the rule. These pictures interest visitors who do not care much about technical questions in portrait painting nor about subtle points concerning atmosphere and compositions in landscapes, and often, too, they interest the painters themselves, for it is not unusual to find men of good equipment telling stories in their pictures, and others find in figures doing something more than standing up to be painted a congenial theme for the exercise of tried abilities. In this latter class, for example, is Mr Henry with his large picture in the south gallery, "Sunday Morning," No. 205. The scene shows an ancient stone church in a country town in New Jersey, or in Virginia, probably, with four great round pillars supporting the roof of the porch, and a gallery staircase built under it leading up to the second story. Weeping willow trees on the one side and tall shade trees on the other, a broad stretch of green grass and a summer sky form the setting for this architectural feature. This is the mise en scene, *and the personages appear in the foreground, walking away at the close of services from the church to the carriages and gigs or standing about in groups to chat. The people are in the costumes of the early part of the century, and the stuffs are of many brilliant hues. Yellow, green, red, blue, pink, and white appear in the gowns, shawls and parasols of the women, and only slightly less sober tints in the coats and breeches of the men. The reconstruction of this scene of life and manners is so well done as to give an air of naturalness to the picture, and the individual types are all closely studied. The whole picture is carefully and competently painted. It ought to be engraved, or well printed in colors, so that when the original is in the possession of some private owner, or placed in some public gallery, people who will never have an opportunity to look at it may have a copy to hang in their homes. It is a very pleasing picture, and an American document of genuine value.*

A letter to Henry from Dr John Deyo of Newburgh, dated August 30, 1918, adds another chapter to the saga of this painting. It reads in part:

I am very much pleased to learn that through your efforts, and through you and Judge Clearwater, the consistory and others at the Shawangunk Church have been induced to see a light and will refrain from despoiling the unique and historical church which you have made so well known through your art.

I am very much interested in historical matters, being the President of Board of Trustees at Washington's Headquarters and State Museum at Newburgh, also President of Temple Hill Association and a Director of Knox Headquarters Association, all in and near Newburgh. I would be delighted to have you call to see me when I am at home, and I would take pleasure in showing you all these places. You might think one or more of them would be worth while to reproduce in canvas or otherwise.

I thank you very much for your thought in offering me a photo reproduction of one of your recent works. I know I will enjoy it.

1898

283-*a* [BRUYNSWICK CHURCH]

A photograph in the Henry Collection shows another version of this subject. Though the photograph is faded and hard to read, the medium seems to be water color.

This arouses conjecture. It is more probable than the painting on which Henry worked during the famous trip with his wife and Miss Woodruff would be a smaller work and in a medium easier to work than oils. A further point is that the trip took place when Miss Woodruff was a child or a young girl, and in 1898 she would have been a young woman.

What has happened to this version?

Figure 69

Can this be KL. NO. 57, *A Sabbath Morn, Bruynswick, N. Y.*, not illustrated?

284 A CHIP OFF THE OLD BLOCK

Oil on canvas,

Lower left: *E L Henry '98*

Collection: Bernard H. Cone

A Negro boy has just crawled under the fence and is eying the roosting fowl. The scene is night, and pale moonlight illuminates an otherwise dark picture.

285 ONE-SIDED BARGAIN

Water color

This sold for $50 at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916. The catalog gives the information: *E. L. Henry '98*

Cf. NO. 305 and Figure 190

286 THE COUNTRY STORE

Oil on wood, 7½ x10 in.

Lower right: *To my friend G. Inness, Jr., from E. L. Henry, 1911*

Collection: Winfield Scott Clime

Cf AL. p. 28

According to a letter from Mr Clime, a piece of paper pasted on the back of the panel is inscribed: *E. L. Henry, June, 1911. Cut down old sketch made in 1898 and repainted to fit frame.*

This agrees with the photograph in the Album, in which *E L Henry '98* may be seen very faintly in the lower right. Mr Clime's letter gave so good a description of the painting that it was possible to identify its verbal details by the above-mentioned photograph. The painting was given to him by Mrs George Inness jr, after her husband's death.

Mr Cline's description of the painting reads as follows: *The picture is a typical E. L. Henry. To the right, occupying slightly more than one-third of the canvas, is a country store with a porch supported by four columns, and under the porch a display of vegetables in boxes and baskets. There is a large dog lying on the floor of the porch. There is a figure of a man in the store, visible through the door. In approximately the center of the canvas is a white horse hitched to a single-seated rig, the top of which is folded halfway back. This horse is looking at the dog. In the middle*

1898

distance the road crosses a bridge, apparently over a very small stream. One man is leaning against the railing of this bridge and apparently talking to another man. On the same plane back of the horse is the side of a country house. In the extreme distance is part of a small country house, picket gate in front, and small covered porch. At the extreme right of the canvas is a tree which bends over to the left and hides the part of the store that is above the porch. The horse is tied to a hitching post. . . . I almost forgot to say that our picture is a bright sunny one, with a blue sky and fluffy clouds.

Mr. Clime adds:

Mr. Henry died before we went to Cragsmoor, N. Y., but we knew Mrs Henry very well and often called on her, and many times she took us through the house and Mr Henry's studio, showing us his pictures and his historical collection of costumes etc., which we understand were sent to Johnstown, Pa. We are glad to know that our dear friend Charles C. Curran painted a portrait of Mr Henry. (Figure 32) *Mr Henry occupied a unique place among American painters, and it is good to know that a record is being made of his work.*

The Henry estate went to Johnstown, N. Y. The costumes are now in the Brooklyn Museum.

1899

287 WAITING FOR THE FERRYMAN

Oil on canvas, 28x50 in.

Lower left: *E L Henry 1899*

Exhibitions: NAD 1900, NO. 8, as *Waiting at the Ferry;* Century Association 1942, NO. 57

Collection: Albany Institute of History and Art

Figure 165

A photograph in the Henry Collection is inscribed on the back: *The Return from the First Congress. This carriage was imported from France in 1788 by Genl Peter Gansevoort of Albany (the Hero of Fort Stanwix) and was given to me by his granddaughter, Mrs Gansevoort Lansing. This vehicle is now in my collection at Cragsmoor, Ulster Co., N. Y. Washington rode in it with Gen. Gansevoort while on a visit to Albany in 1792. It was driven by a postillion as seen in the picture.*

Cf. Figures 166 and 169

287-*a* WAITING AT THE FERRY

Pencil on paper, 10x11⅞ in.

Lower right: *E L H Oct. 8 '99*

Collection: New York State Museum

Figure 166

Cf. NO. 1088 and Figure 169: another detail for the painting, showing a man in greatcoat, purplish-plum in color, wearing a top hat and leaning on a cane

1899

288 A BROOKLYN FERRYBOAT
Water color
Lower left: *E L Henry, 1899*
Bibliography: KL. NO. 40, as *An Old Ferry Boat (Fulton Ferry, 1832)*

288-*a* CROSSING THE FERRY
Water color on paper, 11¼x20 in.
Lower right: *E L Henry, 1893*
Collection: Mrs Frank E. Miller
Figure 167

289 ENTERING THE LOCK
Water color on cardboard backed, 18¾x26¼ in.
Lower left: *E L Henry '99*
Exhibitions: A History of American Water Color Painting, Whitney Museum of American Art, 1942, NO. 109; Century Association, 1942, NO. 10
Collection: Albany Institute of History and Art
Figure 255
The canal boat is inscribed: *Buffalo Express Packet*

290 INDIAN QUEEN INN, BLADENSBURG, MD., IN 1795
Lower left: *E L Henry, 1899*
Bibliography: KL. NO. 29
Figure 159
Cf. NOS. 143, 327 and 333

291 PASSING THE OUTPOSTS
Water color
Lower left: *E L Henry, 1899*
Bibliography: KL. NO. 46 seems to be another version
Exhibitions: Philadelphia Art Club, water color exhibition, 1900; Water Color Society, 1901
Cf. Figure 185

292 A MORNING CALL ON NARRAGANSETT BAY
Lower right: *E L Henry '99*
A photograph in the Henry Collection is inscribed on the mount, lower right, as above and, lower left: *Painted by E L Henry 1899*

293 A VILLAGE STREET
AL. p. 46.
Lower right: *E L Henry '99*
Exhibitions: Possibly NAD 1901, NO. 240, as *A Village Street, in the Old Stage Days*

294 AT THE WATERING TROUGH
Lower right: *E L Henry '99*
A photograph in the Henry Collection is inscribed on the back: *A party of city men. Been out hunting. In the Shawangunk Mtns.*

1899

295 "HOME AGAIN"
Exhibitions: NAD 1899, NO. 54

296 A SEPTEMBER AFTERNOON
Bibliography: KL. NO. 58
Exhibitions: NAD 1899, NO. 161

297 "A STORMY AFTERNOON"
Exhibitions: NAD 1899, NO. 194

1900

298 A MOUNTAIN POST OFFICE
Lower left: *E L Henry 1900*
Exhibitions: NAD 1904, NO. 117
Figure 81

299 TALKING POLITICS
Lower right: *E L Henry, Oct. 1900*
Bibliography: KL. NO. 63
Figure 219

300 GOOD-BY, SWEETHEART
Water color,
Lower left: *E L Henry, 1900*
Bibliography: KL. NO. 27
Figure 187

A photograph in the Henry Collection (touched up with black and white) is inscribed on the back: *Old Houses, Kingston, R. I. This was before the road was cut down or graded some years ago.*

A water color of this title sold for $65 at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916. The catalog gives the signature as *E. L. Henry, 1900* and describes the picture as *Trooper; Revolutionary period.*

301 CROSSING THE LOG-BRIDGE IN A FRESHET
Wash drawing

This picture brought $52.50 at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916. The catalog gives the signature as *E. L. Henry 1900.*
Cf. NO. 380

302 THE BATTERY AT NEW YORK IN 1660

A photograph in the Henry Collection is inscribed: *The Battery at New York in 1660 and "The Church in the Fort." Governor's Island in the distance. Painted by E. L. Henry for the Guarantee Title and Trust Co., N. Y.*

303 HOME FROM THE PHILIPPINES
Exhibitions: NAD 1900, NO. 145

Is this *Return from the Wars? Cf.* Figure 220

1901

304 FULTON'S FIRST STEAM FERRYBOAT, RUNNING FROM CORTLANDT STREET TO PAULUS HOOK, JERSEY CITY, 1813–14
Reproduced as a calendar in 1901 by Theo. Gubelman, Jersey City
Figure 168

1902

305 A ONE-SIDED BARGAIN
Oil on canvas, 12½x21 in.
Lower left: *E L Henry, 1902*
Bibliography: KL. NO. 48, as *The Peddler, No. 2*
Exhibitions: Probably NAD 1903, NO. 97, as *The Peddler;* American Genre, Carnegie Institute, 1936; American Genre, Whitney Museum of American Art, 1935; Century Association, 1942, NO. 41
Collection: Estate of Francis P. Garvan
Figure 190
Cf. NO. 285; also Figure 195

306 BURGOYNE'S ARMY ON THE MARCH TO SARATOGA, SEPTEMBER 1777
Bibliography: KL. NO. 7, as *Burgoyne's March down the Hudson*
Exhibitions: NAD 1902, NO. 60
Figure 186

There are two copies of the subject in the Henry Collection: 1) a photograph mounted on a stretcher 15¼x29 and colored by hand in oils; 2) the same photograph in black and white, similarly mounted.

The Albany Institute of History and Art can not locate a water color, 12x18½, signed not dated, called *The Army of General Burgoyne.* Are these paintings the same?

307 TIME IS NO OBJECT
Exhibitions: NAD 1902, NO. 367

1903

308 AN OCTOBER DAY
Oil on canvas, 12x22 in.
Lower left: *E. L. Henry, 1903*
Exhibitions: NAD 1904, NO. 313
Collection: Martin E. Albert
Figure 202

The subject is the post office in the center of Cragsmoor. Just down the road, though not visible, is the Cragsmoor Inn. Mrs Henry, wearing a blue sunbonnet and a red skirt and carrying a market basket, is reading a letter as she comes away from getting the mail. With her are the two Henry dogs. Driving away in a buggy are Tom Boyce and his daughter, while other members of the community sit on the porch of the building which serves also as general store. George Inness jr's coachman has just come up, riding a horse, to collect their mail. On this plateau, 2000 feet above sea level, autumn has already turned the leaves orange and red.
Cf. Figure 201

1903

309 PASSING THE OUTPOSTS
Oil on canvas, 17½x28½ in.
Lower left: *E L Henry 1903*
Exhibitions: Century Association, 1942, NO. 42
Collection: Babcock Galleries
Figure 185
Cf. NO. 291

A photograph of this picture at Fraunces Tavern is inscribed: *Passing the Outposts on the old Kingsbridge Road. British Occupation of New York. To the Society of the "Sons of the Revolution." Complts of E. L. Henry, N.A.*

A letter in the Henry Collection refers to this photograph, among others, as follows:

Sons of the Revolution
in the State of New York
Fraunces Tavern
Corner Broad & Pearl Streets
New York City

Sept. 17, 1910

E. L. Henry, Esq., N.A.,
c/o Rev. George S. Baker, D.D.,
205 West 107th St.,
New York.

My dear Sir:

Your very generous donation of five photographs of your own paintings representing Colonial and Revolutionary scenes is received and I beg to express to you the earnest thanks of the Society and our apprciation of the spirit which prompted the gift. The pictures are most appropriate for this building and will add greatly to our collection.

Under separate cover I am sending you one of our acknowledgment certificates.

Yours very truly
Henry Russell Drowne (signed)
Secretary

310 SIR WM JOHNSON PRESENTING MEDALS TO THE INDIAN CHIEFS OF THE SIX NATIONS AT JOHNSTOWN, N. Y., 1772
Oil on canvas, 22x36 in.
Lower right: *E L Henry, 1903*
Collection: Mrs Charles B. Knox

Painted as a commission for the Knoxes. Henry, according to Mrs Knox, "considered it his very finest painting." No copies were made, until the Knoxes realized that the artist felt badly not to be able to duplicate the work. Today there are copies in eight or ten libraries throughout the State. A copy was presented by Henry to the Johnstown Historical Society. It now hangs in Johnson Hall, Johnstown. A water color, *Johnson Hall, Johnstown,* (27½x18, signed and dated 1907,) is listed as belonging to the Albany Institute of History and Art but can not be located.

1903

When Johnstown held an historical celebration in 1922, the painting was acted out as a charade at the Colonial Club. The picture has been reproduced as a postcard. Today the blockhouse at the left of Johnson Hall is gone, but the fort and other blockhouse still stand.
Cf. correspondence, 1910; clippings, 1922

310-*a* A PRESENTATION OF MEDALS BY SIR WILLIAM JOHNSON TO THE TRIBESMEN OF THE SIX NATIONS HELD AT JOHNSON HALL A.D. 1770
Pen and ink on cardboard, 11x16 in.
Lower left: *E L Henry*
Lower right: *E L Henry*
Collection: Johnstown Historical Society; presented by the artist May 1910

A letter from Brigadier General Edgar S. Dudley, U. S. Army, (retired), to Henry, dated May 11, 1910, reads:

I had the pleasure last evening at the meeting of the Johnstown Historical Society to present to them, in your name, the copy of your painting of "The Presentation of Medals by Sir William Johnson to the Tribesmen of the Six Nations at Johnson Hall, 1770." It was much admired and its historic value appreciated.

The society not only gave you a vote of thanks, but also elected you an honorary member of the body, of all of which you will probably be soon notified officially by the corresponding secretary, Mr Carroll. (*Cf.* correspondence, May 19, 1910) *We hope you will visit Johnstown during the summer, and I am sure any suggestions made by you will be thankfully received. Trusting that your health is restored and with kindest regards to Mrs. Henry and yourself, I remain,*

Yours sincerely

Edgar S. Dudley

P.S. It may be well to say also that it was directed that the picture be suitably framed with an inscribed plate showing the name of the donor and hung in the Hall. I would be glad of a suggestion as to the "most suitable" frame. Apparently a flat frame on which the plate can be placed will be appropriate, but I am not the best *kind of a judge in such matters.*

E.S.D.

311 SPRINGTIME
Lower right: *E L Henry, 1903*
Exhibitions: NAD 1903, NO. 160

312 [WATERING THE HORSES]
Lower right: *E L Henry, 1903*

313 THE SURRENDER OF NEW YORK TO THE ENGLISH BY STUYVESANT, 1664
Lower right: *E L Henry, 1903*
Reproduced as a calendar for Title Guarantee and Trust Company, 146 Broadway, New York

1903

314 "OUR LANE"
Water color,
Lower right: *E L Henry '03*
A photograph in the Henry Collection is inscribed on the back: *Water color. Our Lane, Mtn. Sold up there to Mr. Edgar N. Sidman, married Arthur Keller's sister. Sherman Sqr. Hotel.*

1904

315 SPRING
Oil on canvas, 11x20 in.
Lower left: *E L Henry, May 1904*
Collection: Martin E. Albert
Cf. KL. NO. 79, A Wayside Well
The Coddington cottage was the first house up the gully road from Ellenville. The subject is characteristic—rustic cottage, apple trees in bloom, pump. Mrs Coddington is churning while she talks to Harry Cook, a farmer whose rig is hitched by the road.
A letter from Henry to Martin Albert, dated *On Mtn June 14th, 1904,* reads:

I am taking the picture of the horse and wagon, man at well, girl churning etc., which you have wanted so long, and it is at last finished. I worked all the time I have been here since early June and having few interruptions and nature to work from, I have it completed. It is one of my strongest little pictures, I feel. I thought of framing it in a black ebonized frame with gilt flat next to canvass, feeling that the dark wood helped make the contrast greater like looking out of doors from a window. They are more durable and far more effective than gilt. If you don't want it, preferring a gilt frame, you can have your choice, as the frame was included in the price, of course; only if it were to be mine, I should have the heavy dark polished ebonized frame as the picture is very sunny (springtime) and the effect would be bully . . . .
P.S. I had a letter from that firm in Phila. who are making a small replica of part of your picture "An October Day."

316 THE ARRIVAL OF THE STAGE
Oil on canvas, 12⅛x21¼ in.
Lower right: *E L Henry 1904*
Exhibitions: NAD 1905, NO. 38; Century Association, 1942, NO. 1
Collection: Estate of Francis P. Garvan
Figure 158

317 THE MacNETT TAVERN
Water color on paper, 14x21½ in.
Lower right: *E L Henry 1904*
Bibliography: KL. NO 31, as *McNetts Tavern, Germantown, Pa., (Headquarters of Gen. Howe)*
Exhibitions: A History of American Water Color Painting, Whitney Museum of American Art, 1942, NO. 110, as *McNett's Tavern, 1909;* Century Association, 1942, NO. 27.

1904

Collection: Albany Institute of History and Art
Figure 256
Cf. Figure 257

An entry label of the American Water Color Society pasted on the back reads: *General Howe's Headquarters after the Battle of Germantown.*

A photograph of the tavern (still standing in 1868) in the Henry Collection is inscribed on the front of the mount: *The Macnett Tavern, Germantown road, Used by Lord Howe as Hd Qtrs during the and after Battle Oct. 4, 1777. Still Standing.* Another notation reads: *E L Henry from Wm Kulp, Antiquary, 1868.* There is correspondence with Kulp in the Henry files, and it was his old aunt who posed for The Old Clock on the Stairs, NO. 70.

318 GOODBYE, SWEETHEART
Water color on cardboard, 11x16½ in.
Lower left: *E L Henry, 1904*
Collection: Albany Institute of History and Art

Penciled on the backing is the following note: *Original study in black-and-white by E. L. Henry for a water color in possn of A. Lewiston, N. Y. (the "Copper King")*
Cf. NO. 300

319 [MAUD POWELL PLAYS THE VIOLIN]
Lower right: *E L Henry, 1904*
Figure 71

In the Henry Collection there are several photographs and photogravures of this painting. One, the gift of Miss Annette Mason Ham of Providence and Cragsmoor, is inscribed: *To Miss Annette M. Ham. With the best wishes of E L Henry.* Inscriptions on other examples give further information: *A little Negro selling berries is entranced at front door listening to Maud Powell on the violin. She had never before heard such "fiddle playing."* Also: *A Study from nature at Ellenville, N. Y., where the incident happened in 1883.* And: *Photo from painting by E L H in possn of Mrs. Cord Meyer, Great Neck, L. I.*

Major Powell and his family (including Maud, the famous violinist) used to come to Ellenville for the summers, no doubt through Frederick Dellenbaugh, who had been with Powell on his second expedition down the Colorado river in 1871 (*Cf.* Taft, 1939, p. 288–89) and who had become interested in and later married Harriet Otis, who lived on Canal street in Ellenville. Maud Powell used to rent an empty house to practice in. At various times, all boarded at a village boarding house run by Mrs John A. Morse. (McCausland, '41, p. 6–7)

Henry and Maud Powell kept up the friendship, witness the correspondence of December 4, 1891, March 29 and April 21, 1894, which suggests a fairly steady exchange of tickets for concerts and *vernissages.* The first mentioned letter is endorsed by Henry: *Maud Powell, aged 24 years, the great Violin Virtuosa.* She was thus only 16 years old in the picture, if Henry's inscribed date of *1883* is correct.

A photograph (also the gift of Miss Ham) shows her in Henry's studio at Cragsmoor. *Cf.* Figure 72.

1904

All these documents show the foundation in real life for the painting. Henry's incurable habit of "dressing up" his subjects would out, however. Florence T. Taylor, Ellenville librarian, states that there were no stone houses in Ellenville like the one depicted!

320 [STOPPING TO WATER HIS HORSES]
Lower right: *E L Henry, 1904*

At the left is a farm cottage, with an old woman sitting on the porch knitting. In the center is a well, from which the farmer is drawing water for the team of horses, stopped on the road at the right.

321 ARREST OF MAJOR WILLIAM DYRE FOR TREASON IN WRONGFULLY TAXING THE PEOPLE OF NEW YORK
Lower right: *E L Henry, 1904*
Reproduced as a calendar for Title Guarantee and Trust Company, 146 Broadway, New York

322 [THE MAIL STAGE WAITING FOR THE FERRY]
Lower left: *E L Henry*

A photograph in the Henry Collection is inscribed on the back: *A single team mail stage in use from 1830 to 1865. From a drawing made from the old Stage in Concord, N. H., 1904. The picture represents the mail stage waiting for the ferryboat to carry it over. Photod from the painting by E. L. Henry.*

323 THE CLERMONT, FULTON'S FIRST STEAMBOAT
Lower left: *E L Henry, 1904*
Figure 242

A letter, dated February 3, 1911, to Henry from G. B. Schley refers to the Henry painting he bought at the last N.A.D. exhibition. This is pasted on the back of manuscript p. 30, MS. A photograph in the Henry Collection is inscribed: *Purchased by Mr. Schley, who died Nov. 1917*

An undated letter to Henry from F. D. Millet (pasted on the back of manuscript p. 51, MS.) requests data about the Clermont.

Reproduced, apparently as a calendar, by Theo. Gubelman, Jersey City. There is a discrepancy in the date, the copy of this reproduction in the Henry files being dated *1901*.

323-*a* THE "CLERMONT" MAKING A LANDING AT CORNWALL ON THE HUDSON, 1810
Platinum photograph worked up in gouache by the artist, 9⅛ x19 in.
Bibliography: American Historic Prints, Early Views of American Cities etc. p. 53.

The above reference adds:

Date depicted: 1810.
Artist: E. L. Henry, whose penciled signature appears in the lower left corner, and a pencilled presentation inscription in the lower right corner: "To Mr Henry Havemeyer. Complts of E. L. Henry.
We are indebted to this artist for many carefully studied and charmingly drawn "reconstructions" of old time buildings, costumes and events.

Taking a photograph of this touched-up photograph and having it colored, the West Virginia Pulp and Paper Company used this Henry subject for its 1942 calendar, printing an edition of 30,000 copies.

1905

324 ST JOHN'S PARK AND CHAPEL, NEW YORK

Lower left: *E L Henry 1905*

Bibliography: KL. NO. 56

Figure 247

Cf. NO. 79, 325; Figures 112, 248

A photograph in the Henry Collection is inscribed: *As it appeared about 1839–40.*

The literature about this painting reveals Henry's interest in preserving relics of the past. St John's was tenacious in its hold on life; for a half century passed before it was finally demolished. (*Cf.* NO. 79) Till the end Henry struggled to save what he called one of the best examples in America of Sir Christopher Wren architecture. A letter from the secretary of the Borough President of Manhattan, dated June 6, 1913, begins the story:

George McAneny
President

Leo Arnstein
Secretary of the Borough
Louis Graves
Secretary to the President

City of New York
Office of
The President of the Borough of Manhattan
City Hall

June 6, 1913

E. L. Henry, Esq.
Cragsmoor, Ulster County
New York

Dear Sir:

President McAneny has received your note about St. John's Chapel. He has been giving the matter his very careful personal attention, and is now having plans prepared that may very possibly offer a solution. If the engineering difficulties that have been encountered can be overcome, and the old church saved from demolition, he will be very much gratified; and he is doing all that he can to this end.

Yours very truly
Louis Graves
Secretary to the President

An unidentified newspaper clipping, probably 1914, continues

ST JOHN'S CHAPEL UP TO-DAY
Future of Old Episcopal Structure to Be Settled by the Board of Estimate

Old St. John's Episcopal Church, Trinity Parish, in Varick Street, seems sure to go at last. Consideration of the future of the ancient landmark is on the calendar of the Board of Estimate for to-day. It is recommended to

1905

the Board that the Commissioners in the proceedings be asked by the Corporation Counsel either to agree to the removal of the portion of the building encroaching upon the street or to the moving of the building to a position wholly on property belonging to Trinity Corporation.

The report of the city engineers to the President of the Borough of Manhattan shows that an agreement between the city and Trinity Corporation stipulated that the building, part of which was taken in the Varick street widening and title to which has been vested in the city, was to remain undisturbed for two years from July 1, 1914.

A second unidentified newspaper clipping, probably 1916, reads:

MUST ST JOHN'S BE WRECKED?

It is the preservation of such edifices as old St John's chapel in Varick street, a link between the New York of the present and the New York of the past of which there are too few landmarks remaining, which gives a city personality as well as individuality. The metropolis is too prone to forget that it is the sum of all it has been in the past plus what it is today and to take note only of the piles of brick and stone that are new is to lose much of its heritage.

We are told once again that old St John's must go unless public spirited citizens donate the funds necessary to its preservation. Trinity Corporation owns the body of the church; the city had to take title to the front, including the columns and the bell tower which they support, in widening Varick street. In London they would have bent the street into a curve to save them as was done in the cases of St Clement's Danes and St Mary's-le-Strand.

But now the building is falling into decay; if the facade, which should be maintained in spite of the obstruction to the sidewalk, is removed, scarcely a ruin will remain. The congregation has disappeared and Trinity is not willing to provide the upkeep; neither is the city.

Considering the great wealth that Trinity Corporation has accumulated through appreciation in the value of metropolitan real estate, keeping old St John's in repair should not fall as an unbearable hardship upon it. In the two years during which the matter has been in abeyance there have been no public subscriptions toward that end.

A letter to the editor of the New York Times, pasted on the back of manuscript p. 26, MS., reads:

Old Saint John's in Varick Street

An article in your Sunday edition signed H.K.R., has verified what I feared would happen, i.e., the demolition of old St John's in Varick Street. I wrote a few years ago to Mr McAneny of the Board of Aldermen and he generously responded in regard to preserving the portico by allowing the sidewalk to extend out into the street, passing around the bases of the columns and then returning to the new sidewalk line, doing all within his power to preserve the magnificent edifice. But it appears it was all of no use. Trinity Corporation was eager for what the site would bring. So it is being destroyed. Very fortunately, I painted two large pictures of it a few years ago from sketches made in 1867–8. But they give a very poor

1905

idea of the splendid church edifice itself and the wonderful detail in it all. St John's was without doubt the most magnificent example of the Sir Christopher Wren type of church in America—the exterior and the interior particularly. And it is a shame that it was not allowed to stand as a rare example of the early nineteenth century church architecture. Too bad.

E. L. Henry, N.A.

Ellenville, N. Y., Sept. 24, 1918
Cf. MS. p. 324

325 ST JOHN'S CHAPEL

A photograph in the Henry Collection is inscribed: *View taken from the park as it looked about 1840.* Another photograph is inscribed on the back: *Old St John's Chapel from the Park. Park taken away 1867.*
Figure 248
Cf. NO. 79, 324; Figures 112, 247

326 A DISTURBER OF THE PEACE
Lower left: *E L Henry 1905*
Bibliography: Broadway Magazine, August 1908, p. 221
Figure 177

A tear sheet for this article (which is called "A Painter of the Good Old Times" and was by Page Dunbar) is annotated by Henry: *Stone Ridge, N. Y.*, though the church steeple in the picture looks more like the Ellenville church as he represented it.

327 CHANGING HORSES
Lower right: *E L Henry 1905*
Figure 160
Cf. NO. 143, 290 and 333

General Jackson adorns the inn sign in this painting, whereas in Indian Queen Inn, Bladensburg, Md., the sign shows the presentment of an Indian maiden.

328 [WHAT'S THAT YOU SAY?]
Lower right: *E L Henry 1905*

The photograph in the Henry Collection shows a single-seated spring wagon. A woman and a man, the latter apparently the Negro of *Taking Life Easy* (*Cf.* NO. 359) have stopped to talk to an elderly farmer, who is having difficulty in understanding what they say, to judge from his hand cupped behind his ear and the inquiring cock of his head. The small Negro boy perched on the rear seems to be related to the boy in *Returning Home,* KL. NO. 55.

329 WAITING FOR THE NEW YORK BOAT AT STONINGTON, CONN., THE FIRST RAILROAD FROM STONINGTON TO BOSTON
Lower left: *E L Henry 1905*
Figure 163

1905

330 A MORNING CALL
Lower right: *E L Henry 1905*
Lower left: *Copyright 1906 by E L Henry*
Exhibitions: Possibly NAD 1906, NO. 89
The photograph in the Henry Collection is inscribed on the back: *At old Stone Ridge near Kingston, N. Y.*

331 RESIDENCE OF CAPT. WILLIAM KIDD, 1691
A photogravure in the Henry Collection (4⅝x6¾ in.) is from the same Title Guarantee and Trust Co. series as NOS. 302, 304 and 321.

1906

332 KNOX HOMESTEAD
Oil on canvas, 18x24 in.
Lower left: *E L Henry 1906*
Collection: Mrs Charles B. Knox
This painting was a commission for the Knoxes, painted from a photograph of the old family homestead, about 12 miles from Canajoharie. It shows three generations of Knoxes.

333 THE INN AT BLADENSBURG
Wash drawing on paper, 10x15 in.
Lower left: *E L Henry, Bladensburg, Md.*
Exhibitions: Century Association, 1942, NO. 19
Collection: Century Association
A label in Henry's handwriting on the back reads: *The Main Street, Bladensburg, and the Indian Queen Tavern. Presented to the Century Club for the new private dining room, 1906.* The price $50 is marked on an exhibition label of the Boston Art Club, undated.
Cf. NOS. 143, 290 and 327

334 A PRIVATE VIEW: A.D. 1905–1906
Lower left: *E L Henry*
Lower center as above
Lower right: *How we three, a Tumbler Pigeon, a Top Knot Hen, and a Goose, suggested the present Styles of 1905–1906*
Figure 208
A photograph, lent the New York State Museum by Mrs Charles B. Knox of Johnstown, N. Y., is inscribed on the back: *A caricature Exhibition held at the Century Club . . . . This caricature picture was on the style of dress & hats of 1905–6. Title, "private view of the Natnl Academy Exhbtn" showing the Absurdities in Dress.*

335 THE FLOWER SELLER
Lower right: *E L Henry '06*
Exhibitions: NAD 1907, NO. 164
Figure 194
A photograph in the Henry Collection is inscribed on the back: *A study from nature at Cragsmoor, N. Y.*

1906

The setting is front of the cottage now owned by Miss Julie M. Husson and Miss Mary D. Buxton, which they purchased from the Henrys about this time. (*Cf.* Figure 197) The setting has been used in at least one other Henry painting, *Unexpected Visitors*, NO. 355.

336 ON THEIR VACATION
Water color and chalk drawing on paper, 13x20 in.
Lower left: *E L Henry 1906*
Collection: Bernard H. Cone

Two horses are being watered at a trough. They are drawing a carriage containing a man and a woman and a young boy and a dog. A boy and his dog are passing at the extreme right. The picture is inscribed: *Upper part of Ellenville, N. Y., Shawangunk Mts. in the distance.*

337 IN EAST TENNESSEE
Lower right: *E L Henry 1906*

A white girl in a sunbonnet is riding a horse. She has paused to talk with a white woman and man. A Negro woman is leaning out of the window of a shack to watch. There is a house at the right rear.

Can this be NAD 1915, NO. 64, *In the Mountains of East Tennessee?* And Gill, 1917, $250?
Figure 209

338 EARLY AUTUMN
Lower right: *E L Henry 1906*
Figure 180

339 THE CALL BY THE WAY

A reproduction from the Broadway Magazine, August 1908 issue, shows this picture, with the above title and date. A buggy has drawn up at the side of the street and its occupants are stopping to talk to a woman who stands on the hitching block. A man in a tall hat is driving the vehicle, while two women sit behind him.

340 COUNTRY FOLKS
Exhibitions: NAD 1906, NO. 66

1907

341 IN THE OLD STAGE COACH DAYS
Oil on canvas, 24x28 in.
Lower left: *E L Henry 1907*
Collection: Martin E. Albert
Figure 249

The old Terwilliger House stood on the site of the present Ellenville post office. The scene shows muddy street, slabs of stone for sidewalks, cobblestone gutters, hitching posts and all, with the coach leaving the inn. The artist made an addition, however, putting in the church. The oxcart is of the period.

1907

A letter from Henry to J. H. Smith, the original owner of the painting, dated January 12, 1908, reads:

I cleaned it, retouched it in places and varnished it the day before it was called for by the Century Club. It made quite a "hit" there last night and was considered the best work in general "tone" that I had ever yet produced. Out of decency I cannot write you of the comments I heard on the work, but judging from it you have one of my best examples.

A second letter from Henry to Smith is dated August 15, 1915:

That stage picture I considered one of by best works . . . . At present, no one seems to have any money for pictures just now. I haven't sold anything except one small work since last Christmas and all the other artists' complaint is the same except a few portrait painters and in Europe it is deplorable." He advises therefore against attempting to sell the picture until the season begins.

342 SCENE ALONG THE DELAWARE AND HUDSON CANAL
Oil on board, 8x11 in.
Lower right: *E L Henry 1907*
Bibliography: Check list of exhibition, Our Own—Our Native Art, John Levy Galleries, May 10–June 15, 1941, NO. 11
Exhibitions: possibly NAD 1908, NO. 149, On the Banks of the Canal (Miss Anna Riker Spring); Our Own—Our Native Art, John Levy Galleries, May 10–June 15, 1941; Century Association, 1942, NO. 52
Collection: John Levy Galleries
Figure 172

The check list has this to say: *The Delaware-Hudson Canal ran from Harrisburg to Albany and the water right-of-way was later used by the Delaware and Hudson Railroad. This scene is evidently painted in back of Kingston, near Henry's home.*

Here is a scene that might well have illustrated the recent book, "Chad Hanna." E. L. Henry had the clearest eye for catching the spirit of American life at the close of the 19th century. We owe much of our knowledge of the Civil War to his sketches and studies, and his keen eye for character and quaint humor give us a clear picture of our neighbors in the country.

The above suggests the need for documentation of our artists of even the recent past; for several errors of fact creep into the statement about the canal. It did not run from Harrisburg to Albany, but from Honesdale, Pa., to Kingston, etc.

343 FOOD FOR SCANDAL
Lower right: *E L H 1907*
Figure 184

A photograph in the Henry Collection is inscribed on the back: *"Food for Scandal." A village girl has picked up a "Drummer" & invited him out for a Ride in her Buggy.*

A photograph, lent to the New York State Museum by Mrs Charles B. Knox of Johnstown, N. Y., amplifies: *Food for Scandal. A sketch of a village News Depot. The old women watching a village girl who has picked*

1907

up a "Drummer" and taking him for a "Buggy Ride." The oldest saying— "I wouldn't have believed it if I hadn't seed it with mine own eyes." The Hussy!
Cf. NO. 263

344 JOHNSON HALL, JOHNSTOWN, N. Y.
Water color, 18x27½ in.
Signed and dated 1907
Collection: Albany Institute of History and Art
This painting can not be located.

345 ON THE WAY TO TOWN
Exhibitions: NAD 1907, NO. 228

346 WAYSIDE REST
Exhibitions: NAD 1907, NO. 257

1908

347 BEAR HILL
Oil on canvas, 22x26 in.
Lower right: *E L Henry 1908*
Collection: Martin E. Albert
Figure 79

A photograph in the Henry Collection is inscribed on the back: *Bear's Hill on the Shawangunk Mountains. The old Ellenville and Newburg Stage crossing the Mountains on the way to Newburg through Orange Co. Where steamboat was taken for New York City or Albany passengers. Painted for Martin Albert.*

The painting is a sunset subject which combines details of reality and imagination. The present owner, for whom the artist painted the picture, wanted a bridge, cattle, a farmhouse, a stage coach with four horses and the setting sun. So Henry obligingly altered his angle of view. Tired from the pull up from Walker valley, with a full coach, the horses are in a slow walk. The formation of the cliff which gives the pictures its name is true to nature. (*Cf.* Figure 80) Bear Hill is on the top of Cragsmoor and gets its name from the wild life which once abounded on this high ridge.

348 STENTON
Oil on canvas, 14½x23 in.
Lower right: *E L Henry, 1908*
Exhibitions: NAD 1909, NO. 189, as *An Afternoon Reception at "Stenton," the Seat of James Logan, Philadelphia: Time, about 1760*
Collections: James Ben Ali Haggin sr; Louis Terah Haggin; Eila Haggin McKee; Haggin Memorial Art Galleries, Stockton, Calif., NO. 66

349 THE GOSSIPS
Water color, 6⅞x8¾ in.
Lower left: *To cousin Edith with best wishes of E. L. Henry, 1908*
Exhibitions: Century Association, 1942, NO. 13
Collection: Estate of Francis P. Garvan; now in private collection
Figure 181

1908

350 TERWILLIGER TAVERN
Lower right: *E L Henry 1908*
Inscribed on the back of the photograph in the Henry Collection is: *After a black and white by E L Henry. Taken early July 1908.*

351 [A SERIOUS TALK]
Lower left: *E L Henry 1908*
The two photographs in the Henry Collection show a buckboard with two horses. The scene is somewhat different than usual, a road leading up from a bay. There is no evidence to identify it as Rhode Island coast or Long Island. The elderly man driving looks like a reformed Peter Brown and seems to be sitting on the buffalo robe which figures as a property in Figures 137 and 139.

352 "HOME AGAIN"
Exhibitions: NAD 1908, NO. 17

353 [ALONE]
A photograph in the Henry Collection is mounted on a sheet of paper in which corners have been cut. It is inscribed: *Old Gray standing alone in the pasture.* A horse stands by a rail fence and looks lonesomely at the horses in the pasture beyond.

1909

354 [MISS INNESS AND FRIEND]
Lower left: *E L Henry 1909*
A photograph in the Henry Collection is inscribed on the back: *Miss Inness and friend calling on us, Cragsmoor, N. Y.*

355 UNEXPECTED VISITORS
Exhibitions: NAD 1909, NO. 5

1910

356 A STOP AT THE CARPENTER'S
Exhibitions: NAD 1910, NO. 236
Cf. NOS. 200 and 234

357 WHAT LUCK
Lower left: *E L Henry 1910*
Exhibitions: NAD 1911, NO. 221
Figure 261

358 THE ROAD BY THE RIVER
Exhibitions: NAD 1910, NO 17

1911

359 TAKING LIFE EASY
Oil on canvas, 14x22 in.
Lower left: *E L Henry 1911*
Exhibitions: NAD 1912, NO. 100; Century Association, 1942, NO. 59, as *Wayside Greeting*
Collection: James Graham and Sons
Figure 52
Cf. Figure 53

360 [DOING HER CHORES]
Lower left: *E L Henry 1911*
A photograph in the Henry Collection is inscribed on the back: *Sent to Gill exhbtn, Springfield, Mass., & sold there $100—Jany 1917.* The annual Gill catalogs do not list any title which fits the picture. It shows a pasture with a log cabin in the background. A farm girl in sunbonnet and apron is walking down the path toward a pool, from which she apparently is about to dip up water in the pails she carries in each hand. A dog follows her, and horses graze at the left.

361 A MORNING IN JUNE
Exhibitions: NAD 1911, NO. 46

1912

362 A CANAL BOAT ENTERING A LOCK
Water color
Lower left: *E L Henry 1912*
Bibliography: Scribner's, August 1920, p. 253.

363 HAVE YOU HEARD THE NEWS?
Exhibitions: NAD 1912, NO. 99

364 THE TRAMP
Lower left: *E L Henry 1912*
A photograph in the Henry Collection is inscribed on the back: *Photo copy of painting sold at National Academy of Design Dec. 1912, called "The Tramp," by E. L. Henry.*

1913

365 THE BILL COLLECTOR
Oil on canvas, 14x21 in.
Lower left: *E L Henry 1913*
Collection: Dr and Mrs H. M. Sassaman
Figure 203
The painting shows a scene in front of a familiar barn on the "Mountain." (*Cf.* Figures 144 and 145) A Cragsmoor farmer leans against a spring wagon, mopping his forehead, while the bill collector (clad in a frock coat) shakes his finger at the farmer. The farmer's wife watches proceedings through the open barn door, and a horse stretches his head out of the barn window.

1913

366 NEWS OF THE WAR OF 1812
Oil on canvas, 26x42 in.
Lower left: *E L Henry 1913*
Collection: Martin E. Albert
Figure 250

In the distance may be seen Sam's Point, a mile as the crow flies from Cragsmoor, Henry's summer home. An old stone house stands on the country road leading from Kingston. Two women sit in a buckboard, with the driver in the costume of the period. A man in uniform, ready to join his regiment, stands by the side of the road with his bride and her parents. The Negro cook is coming from the servants' quarters to learn the news: that war has been declared on Great Britain. A photograph in the Henry Collection, an enlargement of the center part of the painting, is inscribed on the back: *The Vehicle. From a sketch made in Albany at the Bicentennial. One of the earliest vehicles in America, the body hung on a frame by leather straps. It dated back to just before the middle of the eighteenth century, about 1743 to 5.*
Cf. NO. 1157

367 THE VILLAGE HUCKSTER
Lower left: *E L Henry 1913*
Figure 191

368 [GETTING OUT THE VOTE]
Lower left: *E L Henry 1913*
Figure 251
Cf. Figure 252

1914

369 THE UPLANDS AT BOW
Oil on canvas, 20x33½ in.
Lower left: *E L Henry 1914*
Collection: The First Church of Christ, Scientist, in Boston, Massachusetts
Figure 210

A photograph in the Henry Collection is inscribed on the back: *The Birthplace of Mrs Eddy, Christian Scientist, at "Bow," N. H. Painted for Woodbury Hunt, Concord, N. H.* The New York State Museum has received from the First Church of Christ, Scientist, in Boston, Mass., a copy of the brochure for which this picture was painted. It is: *The Birthplace of Mary Baker Eddy. Bow. New Hampshire, copyrighted 1914 by the Woodbury E. Hunt Company, Concord, New Hampshire.* The title page reads: *Concerning a Painting by Edward L. Henry, entitled The Uplands at Bow portraying the Birthplace of Mary Baker Eddy.* A loose sheet is inserted in the brochure, with prices for reproductions of the painting, as follows:

Popular Edition, Size 12x20 inches

Style A. Platinum prints, gray tones	*$5.00*
Style B. Platinum prints, sepia tones	*5.00*
Style C. Platinum prints, hand colored	*10.00*

Limited Edition, Size 16½x27½ inches

Style D. Hand colored platinum prints only. Price for the first 200 copies $30.00 each

1914

Regarding the painting, the brochure reads in part:

In recent years, much has been done to preserve and restore the birthplaces of illustrious persons and what could be more fitting and proper, than that a study should be made of this homestead, the birthplace of Mary Baker Eddy, the beloved leader and founder of Christian Science and the best known and most illustrious woman that America has ever known. Many months ago it occurred to the writer, [name not given. E.McC.] *an old neighbor of Mrs Eddy, that it would be of great interest and importance, to produce a better picture of this historic birthplace, than had hitherto been issued. . . . To produce an ideal picture, required a vast amount of study and research, also an artist, qualified by experience, to paint it. Mr Edward L. Henry, the eminent New York artist, was selected as the best and only man in the United States for such a composition. Mr Henry has spent a lifetime in painting pictures of this nature and he was a happy selection, as demonstrated by the completed picture. The commission was given him in January, 1914, and the painting was completed in September.*

The greatest credit should be given Mr Henry for his painstaking and conscientious work. Acknowledgment is also made to Mr John Brown Baker, Mrs Eddy's second cousin, and to his son, Mr Rufus Baker, for their uniform courtesies and great helpfulness. . . . It was possible to secure detailed information concerning the house shed and the feeding shed and with a part of the old foundation of the barn still in sight, Mr Henry was enabled to execute his conception of the original.

The painting is an oil 20x33¼ inches in size. It is rich in color and delightful in atmosphere. The small cut shown herewith can give but a faint conception of the beauty of the original. The details of the picture Mr Henry has executed in the most charming and idealistic way conceivable and in harmony with the times. The grass-grown road; the old stone walls; the apple orchard in full bloom; the lilac bushes (in Mrs Eddy's favorite color); the flowering almonds; the well-sweep and old oaken bucket; the old carriage in the shed and wagon in the farmyard; the dog in the doorway; the little blue pitcher in a window; the cat, emerging from the house by the way of the "cat-hole" (a common thing in those days); the two-seated vehicle in the front yard, with occupants dressed appropriately for the period; the milk pans by the south door; the farm fowls about the place; the cow in the barn, all lend an indescribable charm. The general atmosphere of the picture is distinctly that of the period about 1831–32, when Mary Baker was about 10 or 11 years old. Mr Henry has put in the foreground the figure of a little girl, which might well have been Mary Baker, watching with interest the people who have just arrived at the front of the house.

In producing the picture the chief aim was historical accuracy and it is believed a valuable service has been rendered to American history. The eminence of the artist guarantees a valuable and artistic painting; as there could be but one Mary Baker Eddy, so there could never be another E. L. Henry. The original painting is priceless and not at present for sale, but it is hoped that, some day, it will find its home in some important place, where it may be viewed by coming generations. For the present, the painting

1914

has been reproduced for circulation in two sizes, particulars of which may be had on application to the publisher.

On the Baker farm, not far from the house, there has been standing for 150 years or more, an apple tree, blossoming and bearing fruit during all the years of Mrs Eddy's life. It was, indeed, fortunate that this tree could be secured and from the wood thereof a quaint and beautiful frame has been constructed, as a most appropriate setting for this original painting by Edward L. Henry, of Mary Baker's birthplace.

The brochure ends with a page of biographical data, called *Concerning the Artist,* and with a photograph of Henry at work in his Cragsmoor studio on the painting, *The Uplands at Bow.* The biographical sketch reads as follows:

Mr Edward Lamson Henry is a member of the National Academy of Design and the American Water Color Society. He is a painter of genre and historical subjects, having always shown a decided preference for pictures of American country life and for country vehicles and other means of transportation and for pictures of American history. He was born in Charleston, South Carolina, in 1841, came north before the war, studied art in Philadelphia and afterwards in Europe, with Suisse. He occupies a unique place in American art and is one of the best known and most highly respected of American artists. He has a winter studio in New York City, but his summers are spent at his charming home at Cragsmoor, New York, among the Catskills, where, amid the grandeur of the scenery and the superb views, he does much of his painting. He has a rare and unusual personality and those of his friends who have been entertained in his Cragsmoor home, presided over by Mrs Henry, a lady of equal charm and a most delightful hostess, are fortunate indeed. He was on the James River in the latter part of the Civil War, where he made many studies. One of his Southern sketches was "Old Westover," one of the most celebrated colonial houses in America, then the headquarters of Fitz John Porter. "The Headquarters of General Grant at City Point," now in the Union League Club, New York, was his first important work and his large picture, "The First Railway in New York State, 1831," from Albany to Schenectady, is another of his noted compositions. His latest important work is "The Uplands at Bow," portraying the birthplace of Mary Baker Eddy.

370 THE HUCKSTER

Oil on canvas, 13½ x23¼ in.

Lower right: *E L Henry 1914*

Exhibitions: NAD 1914, NO. 319, as *The Huckster's Wagon;* Century Association, 1942, NO. 16

Collection: I. Snyderman

Figure 193

Cf. Figure 196

A photograph in the Henry Collection is inscribed on the back: *On Mountain at Cragsmoor, N. Y.*

The peddler was probably John Howe. The summer house is gone now. (McCausland '41, p. 164, 224.)

1914

371 CONTRASTS

Oil on canvas, 15½x25 in.

Lower left: *E L Henry 1914*

Exhibitions: NAD 1915, NO. 18

Collection: Alida Wells Stetson, Edward C. Wells, Margaret L. Wells and William C. Wells; Albert Dureen

Figure 178

Cf. Figure 177; also Sketchbook 25: CAT. 1209 and Sketchbook 27: CAT. 1211

372 THE FOUR SEASONS

Four small oils originally framed in one large gold frame, each small panel being framed in a narrow molding and sunk into gilt matboard. (*Cf.* McCausland, '41, p. 119, on inventory of Henry estate.)

Exhibitions: Gill, 1917, $500

Collection: Alida Wells Stetson, Edward C. Wells, Margaret L. Wells and William C. Wells; Albert Dureen

Pasted on the back is a slip: *The Four Seasons. Painted from Nature. In the Shawangunk Mountains, New York. Each in its season at the same place. E. L. Henry.*

1 Spring

Oil on board, 5¾x9⅜ in.

Lower right: *E L Henry*
1914

Figure 204

2 Summer

Oil on board, 5¾x9⅜ in.

Lower right: *E L Henry 1914*

Figure 206

3 Autumn

Oil on board, 5¾x9⅜ in.

Lower right: *E L Henry*
1914

Figure 205

4 Winter

Oil on board, 5¾x9⅜ in.

Lower right: *E L Henry*
1914

Figure 207

373 ELECTION DAY

Lower left: *E L Henry*

Exhibitions: NAD 1914, NO. 12

Figure 252

Cf. Figure 251; also the photograph pasted on manuscript p. 48, MS. A photograph in the Henry Collection is inscribed on the back: *Nov. 5, 1844, between Henry Clay and James K. Polk*

Cf. MS. **p. 336*f*.**

1916

374 MAIN STREET IN JOHNSTOWN, N. Y., IN 1862
Oil on canvas, 20x30 in.
Lower left: *E L Henry 1916*
Johnstown in 1862
Collection: Mrs. Charles B. Knox
Figure 211

The painting shows the main street of Johnstown in the days when the railroad stopped at Fonda. John Dunn's coach completed the trip to Johnstown. On the route between Buffalo and Albany, along which cattle were driven, Johnstown had a famous inn, the Cayadutta House. Another item of local interest was the annual arrival from New York City of the Livingston coach. This family had a summer home in Johnstown, and the whole community turned out to see their coach drive up. Elizabeth Cady Stanton's home stood on the corner where the People's Bank stands now, beside the inn. The Livingston coach, incidentally, is the smaller of the two seen in the painting.

Cf. Figure 212

375 OLD PETER BROWN OF CRAGSMOOR, N. Y.: TAKING, AS HE CALLED IT "AN EYE-OPENER"
Oil on board, 6x4 in.
Lower left: *E L Henry*
Collection: Mrs Charles B. Knox
Inscribed: *To Mrs Chas. B. Knox. From her friend, E. L. Henry, July 1916*
Cf. NOS. 168, 177 and 187

376 OUT IN THE STORM
Lower right: *E L Henry 1916*
Bibliography: NAD 1917 catalog, illustrated
Exhibitions: NAD 1917, NO. 146
Figure 199
Cf. Figure 198

376-*a* "FORGOTTEN"
Pencil on paper, 2⅜x3⅝ in.
Lower left: *A sketch in the rain, E L H 1894, "Forgotten"*
Collection: New York State Museum
Figure 198
(This drawing is pasted on manuscript p. 23, MS.)
Cf. Figure 199

377 ON THE PORCH
Exhibitions: NAD 1916, NO. 155

This may be the picture, a photograph of which in the Henry Collection is inscribed on the back: *My Back Porch, Cragsmoor, N. Y. Maid Shelling Peas.* It signed, lower left: *E L Henry* ***1915***

378 A VILLAGE STREET
Lower left: *E L Henry 1916*
Figure 200

1917

379 THE OLD CLOCK ON THE STAIRS

Oil on canvas, 20x16 in.

Lower right: *E L Henry 1917*

Collections: Emil B. Meyrowitz; Ernest du Pont Meyrowitz

Figure 214

A letter from Henry to the elder Mr. Meyrowitz, dated July 12, 1917, reads:

I send you by Adams Express today the picture you purchased while calling here some days ago. I hope you will like it. I found after looking it over carefully that I could improve it greatly by painting it over, so I painted it in oil, getting a much stronger, better effect than was possible in water color, particularly as I had not the white water color paper to work on. It was a sort of "labor of love" as they say, for I was over three days on it; but as I felt you have given me the honor of such a long ride up here to see me and my place that I could return the courtesy by giving you a fairly good example of my work in return.

With the picture Henry sent the following statement:

The original of this painting was made from nature in an old Philadelphia house built in the latter part of eighteenth century on Spruce Street. It was the residence of the noted antiquary, William Kulp, and was exactly as it appeared then. His old aunt, sitting in her back private room, reading the morning paper, her cat on a stool close to her.

It struck me at the time as so picturesque that I painted the work from life and it was afterwards sold to a Mr Robert Gordon of London, where the painting is now. The title was the "Old Clock on the Stairs."

E. L. Henry, N.A.

Cf. NO. 70; also MS. p. 320

380 THE FLOATING BRIDGE

Oil on canvas, 22¾x39¾ in.

Lower left: *E L Henry 1917*

Bibliography: KL. NO. 24

Exhibitions: NAD 1901, NO. 185, as *The Floating Bridge Across the Schuylkill, and the "Stage Waggon" of the Latter Part of the 18th Century*

Collection: Mr and Mrs Arthur V. Hoornbeek

Figure 213

Cf. Sketchbook 24: CAT. 1208 and NO. 301.

From Knoedler's library came the following document: *"THE FLOATING BRIDGE ACROSS THE SCHUYLKILL RIVER AT GRAY'S FERRY, PHILADELPHIA, AND THE 'STAGE WAGON' OF 1795." These Stage Wagons ran from Paulus Hook (Jersey City) via Trenton and Burlington to Philadelphia. From there, via Chester, Wilmington, to Baltimore. There were no side doors, the only way of entering being by the front steps and climbing over the seats, which had no backs. The stage was copied from a scale drawing in a work issued at the time—"Mellish's Travels in the U. S., 1795 to 1800." The "Floating Bridge" was, from a description of it, in a work issued a few years ago called, "Twinings Diary" of a trip to America in 1795. I was also aided in some of the details by a*

1917

very old Quaker gentleman of Philadelphia, a Mr William Kite, who rode over the bridge as late as 1816 (when a boy) in a heavy wagon, and his father driving the horses. His account of how the heavy vehicle settled the bridge down so that the water ran in over the bottom of the wheels, and gave me many details which I would have been ignorant of otherwise. This painting was commenced about 1898, and taken up and completed in 1908, and last year it was taken off the old stretcher, was "relined" and entirely repainted, and is as nearly an accurate representation of the hard primitive traveling of those days as it is possible to represent at this present day.

The "Draw" in this bridge can be seen just beyond the leading horses, and was opened and allowed to float down stream, enabling a vessel to pass through, and was then hauled back and fastened, as shown in the painting. The whole bridge was held in place by chains and anchored in the river.

E. Henry, N.A.

A photograph given the New York State Museum by Knoedler's was apparently taken before the painting "was entirely repainted," for it does not show the Georgian mansion in the upper right background on the rise beyond the river. It is the one reproduced in this report.

The Hoornbeeks have a note from Henry, framed with a 4-column cut from the New York Sunday Sun, Sept. 30, 1917, under the heading "In the World of Art." The note (Field Journal p. 32–41) reads as follows: *"The Floating Bridge Across the Schuylkill, Philadelphia, and the 'Stage Wagon' of 1795"*

This bridge was made of logs and planked over and floated on the river, being anchored to prevent it from moving with the current. Generally, it sank a little when a heavy weight passed over it, causing the water to run over the bridge and the rims of the wheels. If vessels wished to pass up or down, the bridge was unfastened at one end, and allowed to drift downstream with the current and afterwards hauled back and secured at the shore end. This picture of the stage was made from a drawing in a book of the time, "Mellish's Travels in North America" and shows what a heavy cumbersome affair it was. It had four cross seats with no backs except the rear one and no way of entering it except by a step over the front wheels, and then climbing over the front seats. The "stage wagon" was drawn by four horses, and often carried the mail. And whatever luggage the passengers carried was generally in small parcels and placed under the seats. It was hard riding, roads very rough, and traveling in those days, unless by private conveyance, very wearisome. This route south "by land" was from New York across the "Jerseys" by stage to Philadelphia, then by this route from Philadelphia to Baltimore via Chester and Wilmington, Delaware, and was the only route south, except by sea in "sailing packets." An excellent account of the above can be found in "Twining's Diary in America, 1795 to 1800," published a few years ago in New York.

E. L. Henry

The photographs in the Henry Collection, including one pasted on the back of manuscript p. 30, MS., all show the picture in its first state, as it was reproduced in Klackner.

1917

381 ST MARK'S IN THE BOWERY IN THE EARLY FORTIES

Oil on canvas, 20x30 in.

Lower left: *E L Henry 1917*

Lower right: *St Mark's in the Early Forties*

Bibliography: Scribner's, August, 1920, p. 252, as *Old St Mark's-in-the-Bouwerie*

Exhibitions: NAD 1918, NO. 34; NAD Centennial Exhibition, 1925, NO. 100, illustrated NO. 26

Collection: Martin E. Albert

Figure 215

Cf. Loose Notes, CAT. 1213

This is a typical Henry subject. Coaches and gigs are waiting outside the church for the wedding party. There are pigs in the unpaved street, just as James Fenimore Cooper had written a little earlier of New York. Gas lamps, a dog team pulling a ragpicker's cart, signposts reading *Boston Road* and *Bowery Lane,* all set the stage for a century ago. Today the old church is covered with stucco, to remove which a campaign is being initiated.

Pasted on the back of manuscript p. 63, MS., there is a photograph of the painting, also a clipping from the Ellenville Journal of February 14, 1918. The item is in quotation marks in the clipping. It reads: *"E. L. Henry, of the Chelsea, 222 W. 23d St., New York, is now at work on one of his interesting canvases of old New York, a picture of old St Mark's in the Bouwerie as it appeared in 1842. A wedding is taking place at the church, and in front are coaches and gigs of the period. A coach on the way to New Haven is in the foreground. Mr Henry is an authority on the costumes and life of the early days in this country. He owns many old vehicles and has made interesting sketches and careful studies of them. For many years the Henry home was directly across the street from old St Mark's, so that Mr Henry knows his neighborhood and subject well. He has at his studio numerous sketches of the vicinity and of other parts of old New York. He is preparing this picture for the coming Spring Academy exhibition."*

A large photograph in the Henry Collection (13¼x15¼) is inscribed on the back of the mount: *A. T. Stewart Died April 10th, 1876. April 10, 1818. Died 42 years ago today. Was buried in a vault, St Mark's Churchyard under the willow tree to the right. His body was stolen from there later in the year.* This bit of information is typical of Henry's interest in necrology, evidenced by quantities of clippings of obituaries in the Henry files.

Another photograph in the Henry Collection has two slips of paper pasted on the back of its mount, one reading: *To. Mr Rawson W. Haddon, Complts of E L Henry, March 16th, 1918,* and the other reading: *"Old St Mark's in the Bowery" as it appeared about 1842. Second Ave. was the old "Boston Road." Stuyvesant Street was then called "Bowery Lane." In the distance can be seen the spire of old St Ann's, Formerly "Father Preston's Church." The present St Ann's was finished 1847, 12th St. below 4th Ave., the original St Ann's was taken down some years ago for*

1917

the subway & the large Wanamaker's new building. Pigs were everywhere in the streets at that time as scavengers, two of which are seen in the gutter at the extreme left. The New Haven stage (seen at the left) started at Park Row and via the Boston Road went via Bridgeport to New Haven, thence via Hartford & Springfield to Boston. The N. Y. & New Haven R. R. was opened for traffic end of 1848. The old willow tree at the right marks the vault where A. T. Stewart's body was stolen from, many years ago.

E. L. Henry

An inscription on a third photograph adds another tidbit: *Old St Ann's, taken down for the subway & Wanamaker's big building.*

None of the photographs in the Henry Collection show the signature and inscription as they appear on the canvas now.

382 MAIN STREET, JOHNSTOWN
Lower right: *E L Henry 1917*
Figure 212
Cf. Figure 211

383 [A DOG'S LIFE]
Lower right: *E L Henry 1917*

The Henry porch and Henry dog provide setting and actors for this story-telling picture of teaching a dog tricks.

384 THE PEDDLER
Exhibitions: NAD 1917, NO. 145

385 [THE TRAMP: 2]
Lower left: *E L Henry 1917*

386 THE OLD GRIST MILL AT NAPANOCH
Oil on paper, 7x10 in.
Lower left: *E L Henry*
Collection: Mr and Mrs Arthur V. Hoornbeek

A photograph in the Henry Collection is inscribed: *Old Mill, Napanoch, N. Y. Taken from oil study from Nature in 1917, the original painted in 1895.* This painting is of the old grist mill in Napanoch, owned by the Hoornbeek family and now used to make pulp (McCausland '41, p. 4). The small oil is possibly painted over a photograph. It was given to the Hoornbeeks by Henry, and a card on the back is inscribed: *The Old Grist Mill at Napanoch. Built in 1709. (Date on it.) Early in the Eighteenth Century During the Reign of Queen Anne. Rebuilt in 1887. From a Study from Nature by E. L. Henry. 1887.* A note has been added by Mrs Hoornbeek: *Old Stone House Opposite, 1741.*

The John C. Hoornbeek Sons Pulp Mill (which makes "wood flour" for linoleum, dynamite, plastics) was rebuilt about 15 years ago after a fire. It is now a corrugated iron building on a steel frame. The old house is falling down for lack of repairs.

1917

387 WAITING FOR THE STAGE
Lower left: *E L Henry*
Exhibitions: NAD 1918, NO. 216
Figure 216
Cf. Figure 217

1918

388 LEAVING IN THE EARLY MORN IN A NOR'EASTER
Oil on canvas, 12x20½ in.
Lower right: *E L Henry 1918*
Exhibitions: NAD 1919, NO. 209; Century Association, 1942, NO. 25
Collection: Estate of Francis P. Garvan, formerly recorded as *Early Morning Stage*
Figure 161

Inscribed on the back: *Study for large painting for man in Chicago, 1899; taken up to finish in 1918. Lined by Beers, West 30th Street.*

1919

389 A RIVER LANDING
Exhibitions: NAD 1919, NO. 25

390 [STAGECOACH DAYS]
Lower right: *E L Henry 1919*

391 [FLORIDA LANDSCAPE]
Oil on board, 10x14 in.
Unsigned and unfinished at the artist's death
Collection: Alida Wells Stetson, Edward C. Wells, Margaret L. Wells, and William C. Wells; New York State Museum
Figure 218

Oils, Water Colors, Prints, Undated

Frequently the only proof of the existence of the work listed is a photograph in the Henry Collection. It is difficult to date Henry's work by internal evidence because of his practice of painting a second version of a popular subject many years after the first was painted. Stylistic variations are relatively slight, therefore. Ascribed titles are enclosed in brackets [ ] and listed in alphabetical order.

900 AFTER THE RAIN
Bibliography: KL NO. 2

901 [AT DUSK]
AL. p. 54

A scene on the "Mountain" at Cragsmoor. The landscape stretches out, not dramatic or spectacular. Cows are going down the road to be milked. An old man sits beside the road, resting, contemplating the evening calm.

902 AT NAPANOCH

Lower left: *E L Henry*

A photograph in the Henry Collection is inscribed on the back: *The Original was sold out of the Nat. Academy Exptn cor. 23d st & 4th Ave many years ago to old Mr Wilson (firm of Earl & Wilson, collar makers, Troy, N. Y.) & is in his attempt at the "Chelsea" West 23d St. Was painted at Napanoch, close to the mills.*

The subject is typical—a country road, a two seated surrey, the driver stopping to talk to the country folk on foot. The reference to the National Academy can not be traced.

903 AT THE FERRY

Bibliography: KL. NO. 3

The photograph in the Henry Collection is in too bad condition to be reproduced, the emulsion peeling away at the edges. It shows a two-seated vehicle covered, with rear wheels larger than front, and three dangling steps. A woman sits in the rear seat, a boy in the front, while a man holds the horses' heads and a second woman has descended to break the monotony of the wait for the ferry, to be seen crossing the river.

904 AT THE OPERA

Water color

This brought $37.50 at the Ortgies Sale, 1887, NO. 54

905 AN AUTUMN MORNING IN VIRGINIA

Bibliography: KL. NO. 4

906 AN AUTUMN STUDY

This brought $35 at the Ortgies Sale, 1887, NO. 58

907 BEFORE THE DAYS OF RAPID TRANSIT

Bibliography: KL. NO. 6; Pageant of America, IV, Figure 167; U. P. Hedrick's History of Agriculture, opp. 252.

In the collections of the Springfield (Mass.) Museum of Fine Arts there is a painting in oils of this subject, 8x19 in. It seems to have been painted over a photograph on a support and is signed lower left: *E L Henry.* It is inscribed on the back: *Original owned by Shepard Knapp.*

908 [A BUGGY RIDE]

Lower right: *E L Henry*

The photograph in the Henry Collection shows a courting couple out for a ride in his fashionable stanhope. They have stopped to talk with two women and a man standing on the sidewalk. The man in the buggy wears a derby and sits with his hand on his thigh; the woman holds a parasol. The man on the sidewalk has one foot up on the buggy's wheel. The couple in the buggy faces out of the picture.

909 [BUYING A FOWL]

The photograph in the Henry Collection shows a buxom housewife in cap and apron dickering with a Negro huckster who holds a scale in his hand to weigh the dangling bird. His jaded nag looks around at the pro-

ceedings, while a woman with a child in her arms stands in the gateway looking on. Across the street is the southern colonial facade of a house where a Negro maid is sweeping the sidewalk. Beside it is a house with a Dutch gabled roof. Approaching from down the street may be seen a white horse.

910 [CALLING THE CHICKENS]

A girl in a sunbonnet and full skirt has come down some steps from a yard and is throwing grain to the chickens which answer her call.

911 A COUNTRY LANE

NO. 68 in the Ortgies Sale, 1887, not sold

912 A COUNTRY TEA PARTY

Bibliography: KL. NO. 16

913 CROSSING THE BRIDGE

This brought $42.50 at the Ortgies Sale, 1887, NO. 56.

914 CROSSING THE LINES

Bibliography: KL. NO. 18

915 [DAY DREAMS]

A man is sitting on the steps of his little shack, while a woman waters the flowers with a watering-pot. The subject well might "Be it ever so humble, there's no place like home."

The photograph in the Henry Collection shows the signature, lower left: *E L Henry*

916 THE DOCTOR'S VISIT

Water color

This picture brought $72.50 at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916.

917 [THE ERIE CANAL COMPLETED]

The clue to this painting is a reproduction in an unidentified clipping in the Henry Collection. Pretty certainly, the title is not as above.

918 [A FAMILY AT TABLE]

Lower right: *E L Henry*

The photograph shows two women, a man and a child seated at the table. The baby is leaning from his highchair to feed the family dog. *Cf.* NO. 1136

919 [THE FAMILY WASH]

AL. p. 58

A woman is bent over the washtub, while her husband sits (one charitably interprets) tired out by his own proper "man's work."

920 GARDEN IN WARWICK

Exhibitions: **Gill, 1919, $225**

921 [GATHERING BERRIES]

AL. p. 35

Lower right: *E L Henry*

This seems to be a water color to judge from photographs in the Henry Collection.

922 [GOING HUNTING]

A photograph in the Henry Collection shows two men with shotguns over the shoulders and gamebags at their backs, who have stopped to talk with an old farmer standing beside his ox team and wagon in front of his barn. The usual rail fence and country landscape complete the picture.

923 GOING TO TOWN

Exhibitions: Gill; 1919, $375

924 GOSSIPING

Collection: Mabel Brady Garvan Collection, Yale University Art Gallery

This painting can not be located.

925 GOSSIPS

Bibliography: KL. NO. 28

926 INTERIOR

Oil on wood, 5½x7¾ in.

Exhibitions: NAD 1939

Collection: Mabel Brady Garvan Collection, Yale University Art Gallery

This is inscribed on the back: *E L Henry.*

A man and a woman are sitting at a table in an interior of the early republic.

927 INTERIOR OF ST JOHN'S, WARWICK, ENGLAND

Ortgies Sale, 1887, NO. 65; not sold

928 [IN THE GARDEN]

A woman in a sunbonnet, seen through an opening in a vine-covered porch, is picking flowers in the garden. A photograph in the Henry Collection is inscribed on the back: *From Back Door, Mtn., sold 1911 Fall Exhtn.* Could this be *A Morning in June,* NAD 1911, NO. 46?

929 [IN THE VALLEY]

Figure 83

The photograph shows a landscape, somewhat different than Henry's usual style, though the subject matter is familiar. A buckboard is coming down the mountain and driving toward a village, where the characteristic white church steeple is seen. At the right is a gambrel-roofed farmhouse. The quality of design is more formal, more classic, than is usual in Henry's paintings.

930 JACK'S RETURN

Bibliography: KL. NO. 30

931 [JOHNSON HALL]

AL. p. 35

An old woman is sitting on the stoop of a colonial house. A note in Henry's hand reads: *Owned by the Late Mrs Murray of Johnstown, N. Y. Aged 100 years, 1910.* This would seem to refer to Mrs Murray. She sold Sir William Johnson Hall to the Johnstown Historical Society.

Cf. NO. 310

932 JUDGE DALY

Bibliography: KL. NO. 19

933 LEARNING THE TRADE

This brought $115 at the Ortgies Sale, 1887, NO. 53. Can it be *Sharpening the Saw,* NO. 195?

934 THE LONG GOOD-BYE

This brought $110 at the Ortgies Sale, 1887, NO. 61

935 THE MARAUDERS: SKETCHED FROM A WINDOW IN WARWICK

This brought $125 at the Ortgies Sale, 1887, NO. 48. Apparently this was bought by Dr Lucien Calvin Warner (*Cf.* NO 175); for Mrs Warner's account book has an entry, under March, 1887, of the purchase of a picture of this name for $125. Nothing further is known of it.

936 MARKETING SATURDAY MORNING

Lower left: *E L Henry*

Figure 259

A photograph pasted on the back of manuscript p. 52, MS., is inscribed on the back: *From the painting by E L Henry, N.A., in the possn of Mr and Mrs Lang of Montclair, N. J.* It shows a companion piece of NO. 367, the woman shopper having gotten down from her equipage and begun to look through the comestibles displayed on the sidewalk outside the store.

937 [A MORNING CALL]

Cf. New York State Museum photograph to differentiate from other similar subjects. (Baldwin 667.)

938 MORNING CALL IN 1800

Exhibitions: International Exhibition, Philadelphia, 1876, NO. 130, p. 20, Official Catalogue, U. S. Centennial Commission

Collection: C. S. Smith, 1876–?

939 NEAR THE BRANDYWINE

Etching, 16½x26½ in.

Bibliography: KL. NO. 35

Collection: New York State Museum

Figure 243

940 [NEIGHBORS' MEETING]

A buggy has drawn up beside a single-seated buckboard, the two vehicles facing in opposite directions. Two women are in the buckboard, a man and a woman in the buggy. This scene is a familiar theme of Henry.

941 OFF THE MAIN ROAD

Lower left: *E L Henry*

Figure 254

A photograph in the Henry Collection is given this title by an inscription on the back. It shows the back of a farmhouse with two-storied back porch. The daughter of the family is scrubbing away at a tub and washboard, the mother talks to a man who is drawing up a bucket of water from a well, and the man's wife sits dourly in a buggy holding the reins.

942 OLD ENEMIES

This brought $200 at the Ortgies Sale, 1887, NO. 70.

943 OLD GRANDFATHER

Bibliography: Klackner, (earlier edition), illustrated, no number, platinotype 8x6½, $1

944 OLD WARWICK

Bibliography: KL. NO. 43

945 ON GUARD

Water color

Ortgies Sale, 1887, NO. 52; not sold

946 [ON THE CANAL]

Oil on canvas, 14¼x22¼ in.

No signature or date.

Collection: Albert Duveen

This painting, probably unfinished, shows a scene on the Delaware and Hudson canal, with the Shawangunk mountains in the background.

947 ON THE WAY HOME

Water color

This brought $22 at the Ortgies Sale, 1887, NO. 47.

948 A PASSING SHOWER

This brought $185 at the Ortgies Sale, 1887, NO. 69.

949 THE PHAETON

Oil on cardboard, 14½x20¾ in.

Lower left: *E L Henry*

Exhibitions: Century Association, 1942, NO. 43

Collection: Albany Institute of History and Art

950 THE PLANET (CAMDEN & AMBOY R. R.)

Bibliography: KL. NO. 49

951 PLEASANT MEMORIES

This brought $62.50 at the Ortgies Sale, 1887, NO. 59.

952 PRINCE OF THE MOHAWK

Bibliography: KL. NO. 50

Can this be *King of the Montauks,* an oil 12x16 in., dated 1880, lent anonymously to the Century Association exhibition of 1942, NO. 22? The Klackner entry is not illustrated, so the point can not be checked.

953 READY FOR THE POST

Bibliography: KL. NO. 52

954 THE REPAST

This brought $37.50 at the Ortgies Sale, 1887, KO. 73.

955 THE RETURN FROM JOURNEY

Bibliography: KL. NO. 54

956 RETURN FROM THE WARS

Water color and crayon on paper, 15x23½ in.
Lower left: *E L Henry*
Collection: Albert Duveen
Figure 220

Is this *Home from the Philippines? Cf.* NO. 303

957 RETURNING HOME

Bibliography: KL. NO. 55
Cf. [*What That's You Say?*] NO. 328

958 ROADSIDE CHAT

Oil on canvas, 5x7 in.
Lower right: *E L Henry*
Collection: F. Newlin Price

959 SOLITUDE, COAST SCENE

This brought $50 at the Ortgies Sale, 1887, NO. 71.

960 STUDY FROM DOOR AT FULHAM, LONDON

This brought $50 at the Ortgies Sale, 1887, NO. 72.

961 THE SURPRISE

This brought $42.50 at the Ortgies Sale, 1887, NO. 51.

962 THRASHING MACHINE

This brought $35 at the Ortgies Sale, 1887, NO. 49.

963 [TOLL GATE]

The painting shown in the photograph in the Henry Collection is related to NO. 242, in so far as the general subject matter is the same, the buckboard, the Evanses, the old woman coming out of the tollhouse to collect the toll etc. This picture differs, however, to the extent that the Evanses have with them in the buckboard a child in a very fancy cap and holding tenaciously to a basket.

964 UNION LEAGUE CLUB, 26th STREET AND MADISON AVENUE, IN THE OLD GEROME MANSION
Oil on canvas, backed with wood,
Lower right: *E L Henry*
Collection: Union League Club, presented by William E. Benjamin, 1925

965 VACATION DAYS
Bibliography: KL. NO. 69

966 VILLAGE GOSSIPS
Bibliography: KL. NO. 70, not illustrated
Is this NO. 263 or NO. 343?

967 A VILLAGE STREET
Oil on canvas, 12x10 in.
Lower right: *E L Henry*
Collections: James Ben Ali Haggin sr; Louis Terah Haggin; Eila Haggin McKee; Haggin Memorial Art Galleries, Stockton, Calif., NO. 67

968 WAITING FOR THE FERRY
Bibliography: KL. NO. 76

969 WAITING FOR THE STAGE
Bibliography: KL. NO. 77, not illustrated

970 WAITING UP FOR HIM
This brought $135 at the Ortgies Sale, 1887, NO. 63.

971 THE WATERING TROUGH
Oil on canvas, 12x16 in.
Lower right: *E L Henry, 1900*
Exhibitions: American Genre, Whitney Museum of American Art, 1935; Century Association, 1942, NO. 34, as *The Old Caleche*
Collection: Salmagundi Club

972 THE WATERING TROUGH
This brought $45 at the Ortgies Sale, 1887, NO. 57.

973 WAYSIDE GOSSIP
Bibliography: KL. NO. 78, not illustrated

974 A WAYSIDE WELL
Bibliography: KL. NO. 79

975 WEARY WAITING
Water color, 11x18 in.
Unsigned
Collections: James Ben Ali Haggin sr; Louis Terah Haggin; Eila Haggin McKee; Haggin Memorial Art Galleries, Stockton, Calif., NO. 181

976 A WEDDING IN THE EARLY FORTIES

The only direct evidence of the existence of this painting is a photograph seen at the home of R. T. Cookingham, 163 South Main street, Ellenville, inscribed as above and: (*Painted from a study of the old Vernooy House at Napanoch, N. Y.*). The photograph shows bride and groom departing from a house of southern colonial type, the old "Vernooy Place." Negro servants are speeding the newly wed couple, a man servant putting luggage on the back of a coupe with the top down, while a Negro driver sits on the box ready to crack his whip and drive off in style.

There is considerable myth about the picture, however. A cousin of Mrs Henry, a Wells from "out West," made a lot of money (rumor is vague as to how) and came back east. He saw Henry's painting of the "Vernooy Place" and bought it, then liked the house so well he bought it also. On his death, his widow married again, according to legend her sons' tutor, and seems to have vanished from the scene. Perhaps the picture went with her?

(Was this Wells, N. W. Wells, who wrote Henry January 23, 1894, on the letterhead of Wells & Nieman, Millers and Grain Merchants, Platte Valley Roller Mills, Schuyler, Neb.? He had seen the large railroad picture in the Transportation Building at the 1893 Chicago World's Fair and wrote to express admiration, adding: *Give my love to my dear Cousin and tell her I often think of her.*)

The "Vernooy Place" was built in the 30's of the last century by the Southwick family. Later the Vernooys lived there. After Mr Wells' death, the place was purchased by Raymond G. Cox, an Ellenville lawyer, who was the executor of the estates of Mr and Mrs Henry. Today it houses a hospital for mental diseases and is sadly grown up with trees and shrubbery.

The Henrys stayed at Napanoch, three miles from Ellenville, at various times. Sometimes they boarded with Miss Grace Denman, who lived on the hill up behind the Vernooy house. Mrs Richard Hayden of Ellenville has two Henry platinotypes, *The Old Toll Gate* and *The First Railway Train*, which Miss Denman had given to Mrs Hayden's mother.

Miss M. J. DuBois, now of Kingston, whose father was president of the bank in Ellenville, and who lived with her family in Napanoch at that time, relates that Henry used to come to their house a great deal when he came to sketch in Napanoch. She adds that Mr Wells paid $300 for a painting he bought from Henry.

For the above data *Cf.* McCausland, '41, p. 40, 50–1, 67, 97–8, 123–24, 245–46.

Napanoch: A Wedding in the Thirties (a water color which sold for $65 at the sale of the Frederick Halsey Collection at the Anderson Art Galleries in 1916) may be the same work.

There are four photographs of the "Vernooy Place" in the Henry Collection, showing different views. An inscription on the back of one notes: *"Southwick," Napanoch, built 1830. Bought by Mr Wells of Omaha in 1904. He died in 1910 & it is now owned by Mr Seamen of Yama Nouchi Farm, Napanoch. E. L. Henry 1917.*

977 [WOODLAND COURTSHIP]

Lower right: *E L Henry*

A photograph in the Henry Collection shows this scene—a young woman has been interrupted at reading a letter, perhaps from a rival of the young man who comes around a tree to intrude on her shady nook.

Sketches in Oil and Water Color on Wood, Canvas and Paper in the Henry Collection

1001 AFTER DAVID [*circa* 1875]
Oil over paper pasted on wood, 9x12 in.
Figure 51

1002 APPLE TREES
Oil on cardboard, 15x20 in.

1003 APPLE TREES IN BLOOM
Oil on wood, 8½x10⅝ in.

1004 THE ARBOR
Oil on paper, 8x10¾ in.

1005 ASLEEP
Oil on canvas, 7¾x10¾ in.

1006 THE BACK FENCE
Oil on paper, 10x14 in.

1007 BACK YARD AT CRAGSMOOR
Oil on paper, 10x14 in.

1008 BANQUET HALL, BANBURY
Oil on canvas, 14⅝x19½ in.

1009 BANQUET HALL, BANBURY: ENTRANCE DOOR FROM ALLEY WAY
Oil on canvas, 13¾x10¾ in.

1010 BEACH WAGON
Oil on paper, 7⅜x9⅝ in.
Figure 45
This may be related to the Easthampton scenes. *Cf.* Figures 46–50.

1011 BY THE LAKE
Oil on canvas, 12½x21 in.

1012 BY THE OCEAN
Oil on paper, 9¾x13¾ in.

1013 CHOPPING WOOD
Oil on wood, 11x7½ in.
This is obviously a Cragsmoor character; but *who?* A white-haired man, clad in brownish coat and greenish cap, holds an ax in his right and a branch in his left, as he chops wood.

1014 CITY POINT, VA., NOV. 1864
Oil on paper, 7⅜x14 in.
Lower right as above
Cf. NOS. 45, 49, 96

1015 COLONIAL DOORWAY
Oil on canvas, 16¾x11½ in.
Figure 221
Cf. NOS. 110 and 116

1016 CORNER CUPBOARD
Oil on wood, 5 5/16x3⅞ in.

1017 COUNTRY BACK YARD
Oil on canvas, 12x18 in.

1018 A COUNTRY ROAD
Oil on canvas, 7x14 in.

1019 CRAGSMOOR SCENE
Oil on paper, 10x14 in.

1020 DOORWAY
Pen and ink with water color wash on paper, 10x14 in.
Figure 222
Detail for *The Meeting of Gen. Washington and Rochambeau,* NO. 109

1021 EARLY NOVEMBER, ELLENVILLE, N. Y., 1905
Oil on wood, 6½x10 in.
Lower left: *Nov. 1905*

1022 FLOWER STUDY
Oil on canvas, 8x7 in.

1023 FROM AN OBSERVATION CAR
Oil on paper, 14x10 in.
This shows the shape of a frame, as in *From a Window, Newport,* 1866, NO. 62

1024 FROM SAM'S POINT
Oil on cardboard, 7⅜x9⅝ in.

1025 A GARDEN
Oil on wood, 5½x8 in.

1026 GARDEN AT HENRY'S HOME
Oil on paper, 10x14 in.

1027 GARDEN FENCE
Oil on canvas, 9x14½ in.

1028 GARDEN SCENE
Oil on canvas, 14x11 in.

1029 THE GHOST ROOM, ST. JOHN'S
Oil on paper, 10x14 in.
This sketch is inscribed on the back: *The Ghost room, St John's. This sketch painted from Nature, August 1876. A Lady dressing for a ball in this room in 1626 was burned to death by her dress catching fire. Her father had the family arms and her initials placed over the door to commemorate the event. A. S. (Ann Stoughton) 1626.*

1030 THE HENRY HOME AT CRAGSMOOR
Oil on wood, 4½x5¼ in.
The sketch shows the garden with a pitchfork stuck in the earth and a basket lying beside it. The house is in profile against the sky.
The date, *June 25, 1892,* is carved on the wood panel.

1031 HOLLYHOCKS
Oil on canvas, 14½x9 in.

1032 HORSE
Oil on paper, 7x10 in.
Lower left: *E L H*

1033 HORSE
Oil on paper, 14x10 in.

1034 HORSE
Oil on cardboard, 9¾x4¼ in.

1035 HORSE
Oil on cardboard, 7x3 in.

1036 HORSE FACING LEFT
Oil on wood, 7x10 in.

1037 HORSE FACING RIGHT
Oil on wood, 4x7½ in.
On the back, vertically, are the forelegs of a bay horse.

1038 HORSE IN HARNESS FACING LEFT
Oil on canvas, 14½x16 in.

1039 HORSE IN HARNESS FACING LEFT
Oil on canvas, 13x15 in.

1040 HORSE IN HARNESS FACING LEFT
Oil on wood, 7x10 in.

1041 HORSE GRAZING
Oil on wood, 7¼x4⅛ in.

1042 HORSE LOOKING OVER FENCE
Oil on board, 8x10¼ in.

1043 HORSE ON TOW PATH
Oil on wood, 7½x4⅛ in.
Collar and tow line are plainly shown.

1044 HORSE'S HEAD
Oil on canvas, 17x11½ in.

1045 HORSE'S HEAD
Oil on wood, 8⅛x4⅞ in.

1046 HORSES
Oil on paper, 10x14 in.

1047 HORSES
Oil on wood, 7x13 in.
On the back, vertically, there is a man on a horse. He wears a blue coat and tall hat.

1048 HORSES
Oil on wood, 7½x4⅛ in.
On the back, in pencil, there is a horse harnessed to the shaft of a buggy, shown in a head-on view.

1049 HORSES STANDING
Oil on paper, 7½x3½ in.

1050 HORSES WITH BUGGY
Oil on canvas, 7½x9 in.

1051 THE LAFAYETTE COACH
Oil on canvas, 15x19 in.
Lower right: *This sketch after nature, made at Chittenango, N. Y., Sept. 1882. E. L. Henry*
Lower left: *The So-called Lafayette Coach. It was built for President Monroe. And Lafayette on his visit in 1824 rode in it with the President through the City of Baltimore and Back to Washington. It was in the early thirties purchased by the Hon. Abraham Yates and inherited by his daughter, Mrs. Brinkerhof. This carriage was afterwards purchased by the U. S. Government and presented to France where it is now.*
Figure 224

1052 MAIN STAIRWAY, ST JOHN'S, WARWICK
Oil on canvas, 18½x15½ in.
Lower right: *E L H '76*
Lower left: *Warwick, Eng. '76*

1053 MRS. FRANCES L. HENRY
Oil on canvas, 16¼x13 in.

1054 MOUNTAIN RAINBOW
Oil on paper, 7x10 in.

1055 NEGRO BOYS
Oil on canvas, 11x9 in.

1055-a NEGRO BOY AND GIRL ON OXCART
Oil on wood, 9¾x14 in.
Lower right: *Aug. 1930, found in the Studio of E. L. Henry, N.A., by Chas. C. Curran, N.A., removed by permission of executor*
Collection: New York State Museum. Presented by Charles C. Curran, 1941
Figure 226

1056 NEGRO GIRL HOLDING CAT
Oil on canvas, 11x6 in.

1057 NEGRO STABLEBOY
Oil on paper, 10x14 in.
Figure 156
Detail for *The Relay*, Figure 157

1058 NEGRO WOMAN AND CHILD
Oil on wood, 7x3½ in.
The woman is shown as a full length figure facing right. She wears blue with a white apron. High shoes, a hat with red roses, and gold earrings complete her costume. The child wears a pink dress and blue bonnet.

1059 NEGRO WOMAN WITH HANDS ON HIPS
Oil on wood, 11½x5⅝ in.
The woman, a standing figure, is in white with a red belt. Her hands are on her hips.

1060 NEGRO WOMAN IN WHITE
Oil on cardboard, 7¾x4¼ in.

1061 OLD CLOCK ON THE STAIRS
Oil on wood, 10½x8 in.

1062 OLD MAN ASLEEP IN A ROCKING CHAIR
Oil on paper, 5x7 in.
Lower left: *Goshen, Sept. 1872*

1063 OLD MAN AT A TABLE
Oil on paper, 4¼x4¼ in.
Lower right: *E L H 1872*

1064 OLD WOMAN IN A ROCKING CHAIR
Oil on canvas, 11x10 in.

1065 OLD WOMAN READING
Oil on paper, 10x14 in.
Cf. painting of the same title, NO. 81

1066 OLD WOMAN WRITING
Oil on paper, 9¾x13¾ in.

1067 ONE OF THE BEDROOMS, ST JOHN'S
Oil on canvas, 14x22 in.
Lower right as above

1068 ON THE BEACH
Oil on wood, 5⅞x11⅞ in.
Figure 46
Related to Easthampton scenes, Figures 45, 47–50

1069 ON THE "MOUNTAIN"
Oil on paper, 10x14 in.

1070 ORCHARD AND HOUSE
Oil on canvas, 10½x16 in.

1071 ORCHARD AND HOUSE
Oil on wood, 6x8 in.

1072 OXCART AND OXEN
Oil on paper, 6x8 in.

1073 THE PORCH
Oil on canvas, 10¾x13½ in.

1074 ROSES AT CRAGSMOOR
Oil on canvas, 10½x15 in.
Lower left: *June 22 '94*

1075 SAG HARBOR (?)
Oil on canvas, 7x12½ in.

1076 STONINGTON
Oil on paper, 10x14 in.
Figure 244

1077 STOVE
Oil on paper, 12x8 in.

1078 STREET IN NAPLES
Oil on canvas, 4½x3½ in.
Lower right: *H*
Lower left: *1861*
A sketch for the painting of the same title, NO. 42

1079 STUDY OF A CHURCH, NEW YORK
Oil on card, 11½x9½ in.

1080 STUDY FOR *ALT KIRCHE*
Oil on paper, 10x14 in.
Figure 246
Cf. NO. 100

1081 SUNFLOWERS
Oil on canvas, 7x12 in.

1082 SUNSET
Oil on paper, 7½x14 in.

1083 SUNSET
Oil on paper, 8½x10 in.

1084 SUNSET AT CRAGSMOOR
Oil on wood, 6x8 in.

1085 TAKING A NIGHT CAP
Oil on paper, 10x14 in.
Detail for painting of the same name, NO. 112

1086 TREE IN PASTURE
Oil on paper, 14x10¼ in.

1087 TWO TREES
Oil on wood, 10x6¼ in.

1088 WAITING AT THE FERRY
Oil on wood, 10x6¼ in.
Figure 169
Detail for painting of same name, NO. 287

1089 WAITING FOR THE STAGE
Oil on paper, 11½x10 in.
Lower left: *Posed by Miss M. E. Powel, Newport, R. I., 1872*
Lower right as above
Figure 217
This sketch was used for the painting of this title, NO. 387

1090 THE WELL
Oil on paper, 10x14 in.

1091 WHITE FRIARS, COVENTRY
Oil on paper, 11½x9 in.
Inscribed on the back: *Sketched by E L Henry July 1876*

1092 WILD AZALEA BUSH
Oil on paper, 10x14 in.
Lower right as above

1093 WOMAN AT A TABLE
Oil on paper, 10x8 in.

1094 WOMAN IN A CITY INTERIOR
Oil on wood, 4½x6⅛ in.
A woman is sitting, at the left, on a sofa, facing right. In the center of the composition there are four casement windows, framed in curtains looped back.

1095 WOMAN IN A COUNTRY INTERIOR
Oil on wood, 8x11¾ in.
A woman is standing center rear at a table. Two lanterns hang on the wall above her. At the left, a white door opens out. At the right, through another, a second open door may be seen. At the left under a window, a second table is set. The effect of the interior is rustic, but the furniture is of period style.

1096 WOMAN IN A VICTORIAN INTERIOR
Oil on wood, 6¼x5⅞ in.
A woman, facing right, is sitting at the left. Above and behind her is a window with curtains looped back. In the center rear there is a tall mahogany colored commode, with a full length mirror, showing the woman's figure reflected. A corner of a fireplace and overmantel mirror may be seen.

1097 WOMAN IN BLUE
Oil on canvas, 6x4½ in.

1098 WOMAN IN WHITE

Oil on wood, 9x7¼ in.

The sketch shows a full length figure, wearing a blue sunbonnet and with a basket over her right arm, coming down a path. A pink belt is an accent of color. The woman is reading a letter.

Is this Mrs. Henry?

1099 WOMAN IN WHITE WITH A RED SCARF

Oil on canvas, 10x5½ in.

Lower left: *Aug 1877*

This seems to be Mrs Henry

1099-*a* WOMAN WITH A BASKET

Oil on wood, 9⅝x7½ in.

Lower right: *Found in the studio of Edw. L. Henry, N.A.; removed by permission of the executor by Charles C. Curran, N.A., Aug. 9, 1930*

Collection: New York State Museum. Presented by Charles C. Curran, 1941

Figure 225

1100 WOODLAND SCENE

Oil on wood, 9¾x12¾ in.

On the back there are three military dress uniforms pictured in blue and buff.

1101–07 MISCELLANEOUS SKETCHES IN OIL ON CANVAS

1108–33 MISCELLANEOUS SKETCHES IN OIL ON PAPER

Sketches in Pencil and Pen and Ink on Paper in the Henry Collection

1134 AT THE WASHTUB

Pencil on paper, 9⅝x7 in., mounted on paper 12⅛x9⅞ in.

Lower left: *E L H*

Lower right: *F L H*

Upper right: *Nov. 18 1873*

1135 BEEKMAN COACH, ABOUT 1772

Pencil and water color on paper, 5x8¾ in.

Lower left: *Beekman Coach, about 1772. Sketched from Nature. Oyster Bay.*

On the back, there are quick sketches (vertical) of a Negro boy in standing poses.

1136 BESSIE AND PETER

Pencil on paper, 9½x5⅞ in.

Lower right: *Bessie & Peter. 218 E. 10. 1871.*

1137 EASTHAMPTON, L. I.

Pen and ink on paper, 4x6 in.

Lower right: *1830 to 60. Easthampton, L. I., 1879.*

On the back there is a sketch of a man with whiskers sitting in a spring wagon, inscribed *Montauk Express.* This is signed, lower right: ***E H 4th** Oct. 80*

1138 **FAMILY CARRIAGE, 1830 TO 45**
Pencil on paper, 6¾ x8 in.
Lower left: *Sketched at Darby, Pa., 1867*
Lower center as above.

1139 **IN ELEVATED TRAIN, 10 P.M., MAY 23, 1910**
Pencil on paper, 7x4 in.
Inscribed across bottom as above

1140 **KNOXVILLE, TENN.**
Pencil on paper, 9⅞ x13⅝ in.
Lower right as above
On the back are quick sketches of two old men.

1141 **NEGRO GIRL**
Pencil on paper, 11x8 in.
Cf. [*Taking a Rest,*] NO. 204

1142 **"NEWLY MARRIED"**
Pen and ink on paper, 11x7¾ in.
Lower right: *E L Henry*
The title, as above, is written on the back.

1143 **OLD CONESTOGA WAGON**
Pen and ink on paper, 5¼ x7⅛ in., (evidently the back of an Eastman booklet, as a printed rectangle may be seen with the slogan: *There is no Kodak but the Eastman Kodak.*)
Inscribed across the bottom: *From Phila to Pittsburg. Old Conestoga Wagon.*
On the back are details of the wagon's construction and the inscription: *Very rare specimen*

1144 **OLD "ROCKAWAY" 1845 TO 60**
Pencil on paper, 4⅜ x6⅜ in.
Inscribed across top: *Old "Rockaway" 1845 to 60. Sketched at Johnstown, N. Y. Belonged to Wm Livingston.*
On the back in, water color, is a sketch of a cottage.

1145 **OLD STAGE SLEIGH**
Pencil on paper, ruled off to 4½ x6¼ in.
Lower left *E L H*
Across the bottom, the sketch is inscribed: *Old Stage Sleigh. The Body Put on Double Runners.*
Lower right: *Quick sketch from Nature, 1871*

1146 **ON THE TOW PATH: 1**
Pencil on paper, 15x10⅝ in.
Figure 173
Two horses are carefully drawn.
On the back are quick rough horizontal sketches of two horses pulling a barge.

1147 ON THE TOW PATH: 2

Pencil on paper, 10¼x15 in.

Figure 175

Two horses are feeding from nosebags.

On the back, two horses are pulling a barge with a boy walking beside them.

1148 ON THE TOW PATH: 3

Pencil on paper, 16½x11½ in.

Figure 174

Two horses are shown with nosebags, feeding.

Figure 196

On the back, is a sketch of a horse and pedler's wagon.

1149 ON THE TOW PATH: 4

Pencil on paper, 8¾x11½ in.

Figure 176

A man is walking at the left, and two horses are pulling a barge.

1150 OXCART

Pencil on paper, 5x8½ in.

1151 "ROCKAWAY" 1850 TO 60

Pencil on paper, 4x6 in.

Lower left as above

Lower right: *3-seated wagon 1850 to 60*

On the back are details of construction of another type.

1152 RUNABOUT 1835 TO 1845

Pencil on paper, with water color, 7⅛x8⅞ in.

Lower left: *Light Runabout formerly in possn of Hon. Abram Yates. Sketched from Nature, 1882.*

Lower right as above

1153 STAGE FROM BROOKLYN TO EAST HAMPTON

Pen and ink and pencil on paper, 4 1/16x5⅞ in.

Lower left: *Sketched from Nature 1880.*

Lower right: *This Stage ran from South Ferry, Brooklyn, to East Hampton in the thirties and forties, 19th century*

A newspaper paragraph pasted on the top center reads: *Charles Ketcham, the last of the drivers of the old mail coach line from Fulton Ferry to Montauk Point, died yesterday at his home near Babylon, aged 92.*

On the back, there are quick sketches of two men's heads and a dog, inscribed: *At Judge Daly's, Sept. 21st '80*

1154 STAGE WAGON: END VIEW

Pencil on paper, with water color, 7x5 in.

Lower left: *E L H*

Lower center: *End View, Stage Wagon, 1820 to 1830*

Lower right: *Sketched at Sag Harbor, end of L. I., 1880*

On the back, horizontal, is the stage wagon's side view. It is signed, lower left: *E L H,* and lower right: *Running from Sag Harbor to the Hamptons in connection with the first Steamboat, 1821.*

1155 "STAGE WAGGON" OF 1821
Pencil and water color on bluish-green paper, 5x7 in.
Lower left: *Used to meet the Steamboat*
Lower center as above
Lower right: *Sketched at Sag Harbor, L. I.*
On the back are sketch of "stage waggon" at wharf and at railroad station with locomotive puffing away.

1156 STUDY FOR "THE FIRST RAILWAY TRAIN"
Pencil on paper, ruled off to 5x9½ in.
Cf. the painting, NO. 257

1157 [VEHICLE] ABOUT 1775
Pencil on paper, 5x8 in.
Inscribed across the bottom: *About 1775. Bicentennial at Albany, 1886*

1158 [VEHICLE] 1830 TO 40
Pen and ink with blue water color, on paper, 7½ x4¾ in.
Inscribed across bottom: *1830 to 40. Sketched, Chittenango, N. Y. 1882*

1159 [VEHICLE] 1830 TO 40
Pen and ink with water color on paper, 7½ x4¾ in.
Lower right: *1830 to 40. Sketched at Chittenango, N. Y., 1882*

1160–84 MISCELLANEOUS SKETCHES IN PENCIL ON PAPER

Henry's Sketchbooks

Numbered chronologically by earliest dates

1185 SKETCHBOOK 1: 1859–61

1186 SKETCHBOOK 2: 1862–90

1187 SKETCHBOOK 3: 1862–64

1188 SKETCHBOOK 4: "War Sketches, Oct. and Nov. 1864"

1189 SKETCHBOOK 5: 1867–1919

1190 SKETCHBOOK 6: 1868–1912

1191 SKETCHBOOK 7: 1869–?

1192 SKETCHBOOK 8: 1871–1902 (?)

1193 SKETCHBOOK 9: (1873–1900s)

1194 SKETCHBOOK 10: 1874

1195 SKETCHBOOK 11: 1874

1196 SKETCHBOOK 12: 1874–80

1197 SKETCHBOOK 13: 1875–79

1198 SKETCHBOOK 14: 1875–76

1199 SKETCHBOOK 15: 1875–76

1200 SKETCHBOOK 16: 1876–79

1201 SKETCHBOOK 17: 1876–79

1202 SKETCHBOOK 18: 1877–80

1203 SKETCHBOOK 19: 1882

1204 SKETCHBOOK 20: 1883–?

1205 SKETCHBOOK 21: 1888–?

1206 SKETCHBOOK 22: 1888–98

1207 SKETCHBOOK 23: (1890–1918)

1208 SKETCHBOOK 24: 1899–1906

1209 SKETCHBOOK 25: 1903–12

1210 SKETCHBOOK 26: 1906

1211 SKETCHBOOK 27: 1908–19

1212 SKETCHBOOK 28 (no dates)

1213 LOOSE NOTES: 1871–1904; 1884–1917

1214 HENRY'S DIARIES FOR 1898 and 1899

Miscellaneous Works by Henry

1215 E. L. HENRY
Silhouette, mat opening 4¾ x3¼ in.
Lower right: *E L Henry 1888*
Collection: Bernard H. Cone
Figure 29

1216 F. L. HENRY
Silhouette, mat opening 4¾ x3¼ in.
Lower right: *F L Henry 1888*
Collection: Bernard H. Cone
Figure 30

1217 STATUE OF GENERAL GANSEVOORT
Bronze, 7 feet 2 inches; with pedestal, about 16 feet in height.
Designer: E. L. Henry
Sculptor: E. F. Piatti
Architect: D. N. B. Sturgis
Presented to the City of Rome by Catherine Gansevoort Lansing, 1906
Figure 188

There is considerable information about the statue which Henry "designed." It was, according to his notation on the photograph in the Henry Collection, *unveiled at Rome, N. Y., Nov. 8, 1906, and erected on the site of Fort Stanwix which he* [Gen. Gansevoort] *so successfully defended against the British general, St Leger, in 1777.*

A letter from Mrs Lansing to Henry, dated October 2, 1906, tells of arrangements for the trip to the dedication:

Your letter of the 30th ult. has been received. How you must have enjoyed your visit with your cousin at the beautiful old home I remember so well in your wedding pictures! I sincerely regret that we were unable to get over to Cragsmoor from Mohonk. If I had been alone, I might have attempted the journey.

I am glad that the bronze tablets have at last been settled upon. I only wish I had been able to express to the architect long ago the reasons for preferring the bronze—as you so well expressed them to me in your letter of two or three weeks ago.

The delay was caused by the non-receipt of the die for the pedestal, which no one seems to be able to account for. Mrs Henry has made a mistake in thinking Nov. 8th falls on Monday. If she looks again in the calendar, she will see that is Thursday.

The plans for the day are this: A special train will leave the Albany Station at 11.15 a.m.. reaching Rome at 1.45 p.m. On the train going up a luncheon will be served. The exercises will be at 2 p.m., and at 4 p.m. the special train is to leave Rome for Albany, so as to connect here with the Empire and allow the New York guests, who so desire, to go home that evening, either by boat or train.

I want you and Mrs Henry to come up to Albany the day before, so that Mrs Henry can have a good night's rest and start out feeling fresh. I am hoping that some of your Johnstown friends will be able to go up with us. Mrs Henry can stay here the night of the 8th, and get another good rest, and then, if you choose, you can go on to Johnstown the next day.

I want you and Mrs Henry to come for my pleasure as well as your own benefit. I am hoping that some of our prominent citizens will meet you both on that day, and in this way get a greater interest in you and your work,—especially the Railroad Picture, which I am still hoping the Historical Society will buy.

I will send you twenty-five invitations, as I before suggested, which you can send to your artist friends, enclosing your own card. It will be a compliment to them, even if some of them are not able to attend the exercises. I hope Mr Havemeyer will certainly come. Do write him and express my desire to meet him and have him come.

A full page spread in the Utica Saturday Globe, November 10th, gives a long account of the ceremony, with illustrations, one halftone showing Mrs Lansing (the granddaughter of General Gansevoort,) standing with her arms full of flowers, and Henry also in the group.

Works Related to the Henry Collection

1218 PORTRAIT OF E. L. HENRY, N.A. by J. G. Brown, N.A.
Oil on canvas, 35x30 in.
Unsigned
Bibliography: "Our Heritage," 1942, p. 16, NO. 46
Exhibitions: Our Heritage, National Academy Galleries, 1942, NO. 46
Collection: National Academy of Design; NAD Catalog NO. 90
Figure 1

The date *1868* is written on the back of the stretcher in blue pencil. The portrait was presented to the Academy by Henry when he became an associate. *Cf.* Figure 3

1219 E. L. HENRY by Sarah E. Cowan
Silhouette, 10x7 in.
Signed: *E. L. Henry 1917*
by Sarah E. Cowan
Collection: Bernard H. Cone

Henry is sitting, brush in hand, palette on his knee.

1220 PORTRAIT OF E. L. HENRY, N.A. by Charles C. Curran, N.A.
Oil on canvas, 20x12 in.
Lower right: *Chas. C. Curran, 1909*
Collections: Frances L. Henry; New York State Museum
Figure 32

A letter from Mr Curran, dated August 8, 1941, reads in part:

I painted the portrait of Mr Henry in his studio while he was actually at work on one of his pictures, as I wanted to get a characteristic pose. His eyes made me think always of an eagle's. Wide open and birdlike. He was very slim and I think he very often sat at his easel with his legs apparently twisted around each other!

I gave the portrait to Mrs Henry . . . .

I am glad to know that my little portrait is in the Museum at Albany. . . . What would Mr Henry have said if he had known what care would be taken to memorialize him!

Cf. McCausland, '41, p. 147, for Mr Curran's first acquaintance with Henry

1221 RHODODENDRON by Frances L. Henry
Exhibitions: NAD 1885, NO. 229, $60
Cf. the painted glass doors in the Henry home at Cragsmoor; also the rhododendron bank beside the Sarine's brook (McCausland, '41, p. 9-b)

1222 IN THE VILLAGE OF BRUNNEN by Worthington Whittredge
Oil on canvas, 12¼x15 in.
Lower left: *W. Whittredge, 1853*
Collection: New York State Museum
On the back of the canvas: *In the Village of Brunnen, Switzerland. Painted in 1853.* **W. W.**

Figure 85 *Great Bend, Susquehanna,* 1858: CAT. 1. Collection, New York State Museum

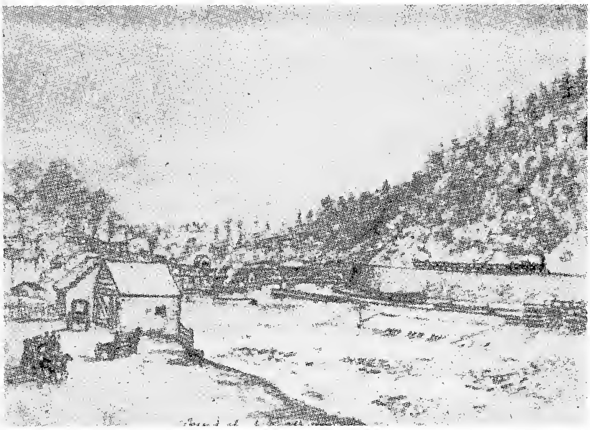
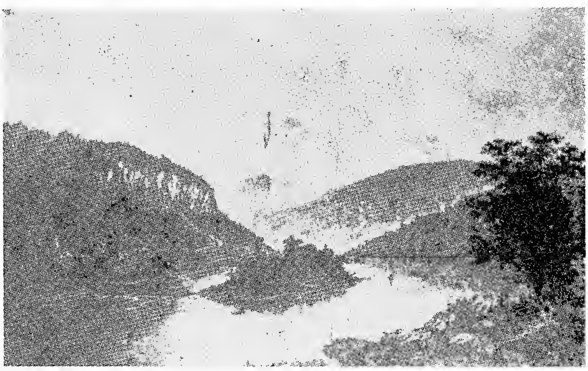


Figure 86 *Mauch Chunk, Pa.,* 1859: CAT. 5. Collection, New York State Museum



Fiure 87 *On the Susquehanna,* 1860: CAT. 16

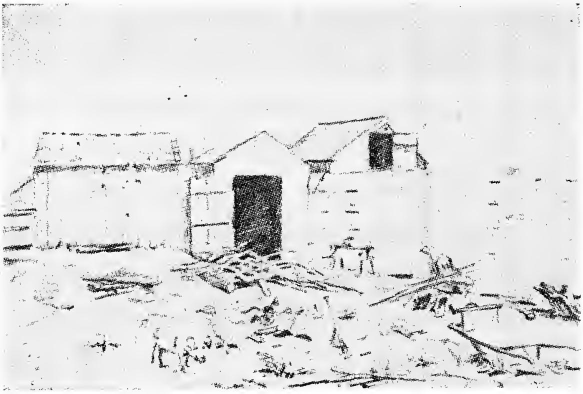


Figure 88 [*Barnyard: 1*], [1859]: CAT. 6. Collection, New York State Museum

Figure 89 [*Bardyard: 2*], [1859]: CAT. 7. Collection, New York State Museum

Figure 90 [*Barn Interior*], [1859]: CAT. 8. Collection, New York State Museum

Figure 91 [*Barnyard*], [1860]: CAT. 11

Figure 92 *Barnyard Scene,* 1860: CAT. 12. Collection, Estate of Francis P. Garvan

Figure 93 *Farm Scene in Pennsylvania,* 1860: CAT. 13. Collection, Estate of Francis P. Garvan

Figure 94 *Una Via in Napoli,* 1861: CAT. 18. Collection, New York State Museum

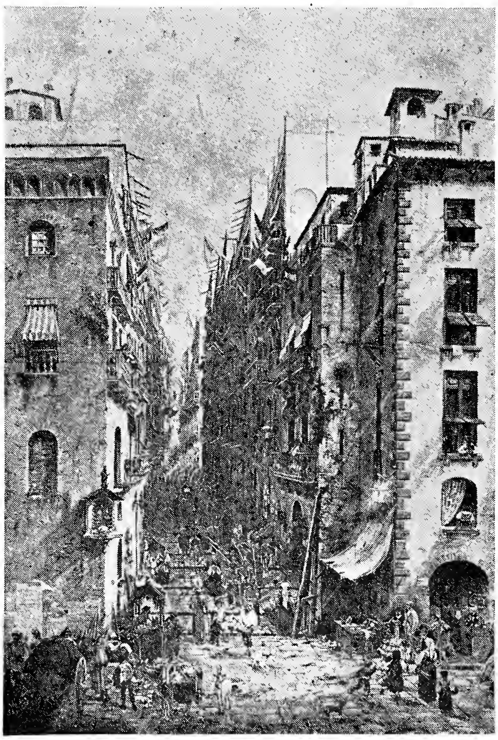


Figure 95 *Street Scene in Naples,* 1864: CAT. 42. Collection, Century Association

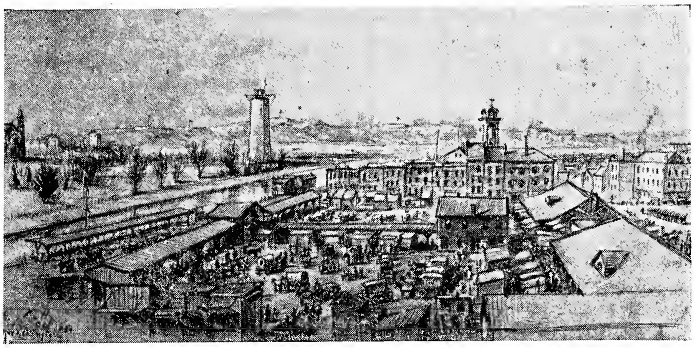


Figure 96 *The Market Place, Washington,* October 1864: CAT. 46. Collection, New York State Museum

Figure 97 *The Great Horse Depot at Giesboro on the Potomac below Washington,* 1864: CAT. 47. Collection, New York State Museum

Figure 98 *Near Harrison's Landing, Lower James River,* November 1864: CAT. 48. Collection, New York State Museum

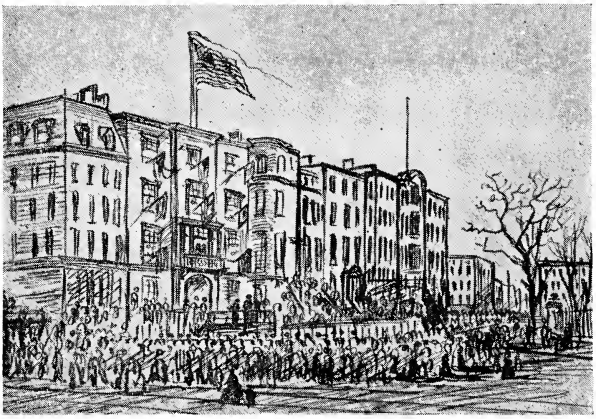


Figure 99 *Presentation of Colors,* [1869 ?]: CAT. 82-*a*. Pen-and-ink. Collection, New York State Museum

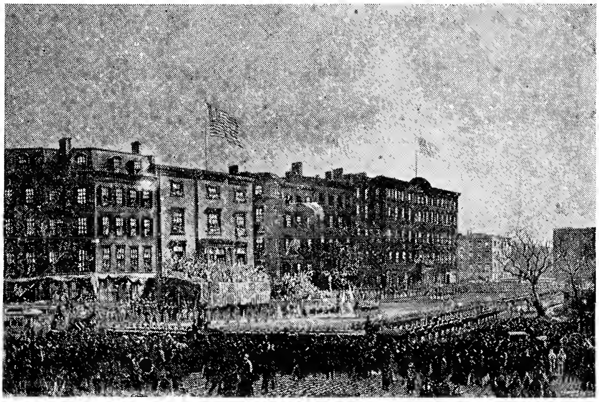


Figure 100 *A Presentation of Colors to the First Colored Regiment of New York by the Ladies of the City in front of the old Union League Club, Union Square, . . . in 1864,* 1869: CAT. 82. Collection, Union League Club

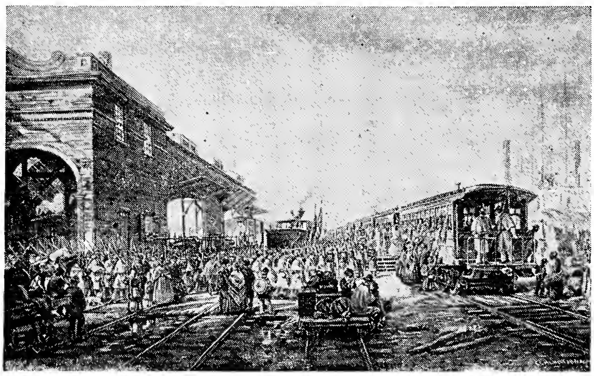


Figure 101 *A New York Regiment Leaving for the Front to Reenforce the Army of Gen. Grant. Scene, New Jersey Railroad Terminal, 1864–5,* 1864–67: CAT. 66.

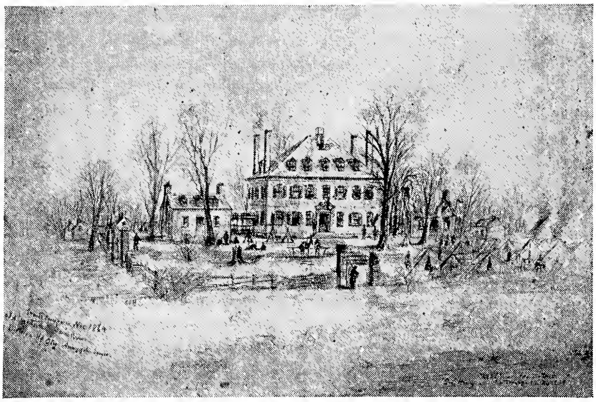


Figure 102 *Westover, James River,* 1864: CAT. 51. Collection, New York State Museum

Figure 103 *Westover,* 1865: CAT. 57. Collection, Century Association

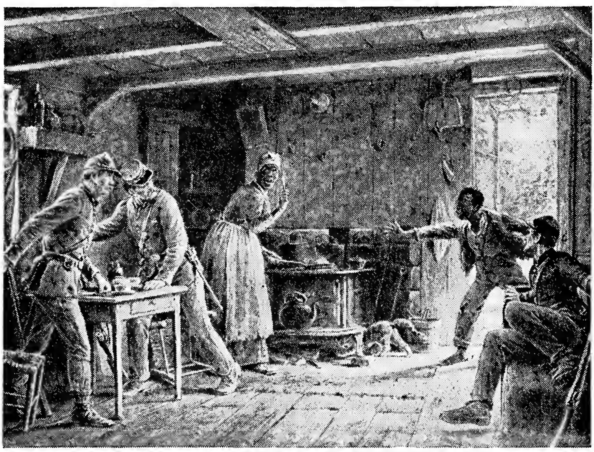


Figure 104 *The Warning,* [1864–67 ?]: CAT. 67-*a.*

Figure 105 *City Point,* October 1864: CAT. 45. Sketch made from a Union transport. Collection, New York State Museum

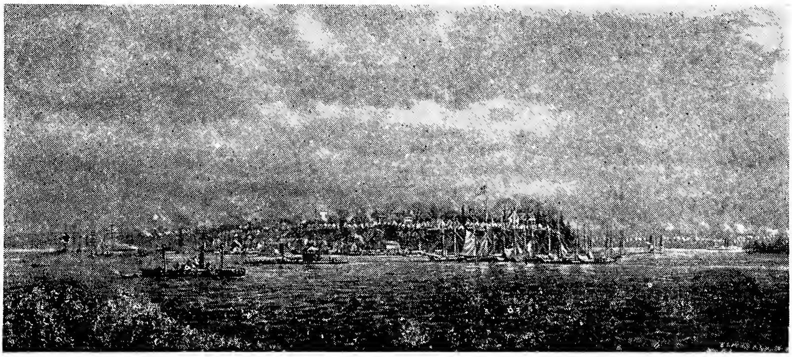


Figure 106 *City Point, Va.,* 1864: CAT. 49. Collection, Harry M. Bland

Figure 107 *City Point, Va.,* 1865–72: CAT. 96. Addison Gallery of American Art, Andover, Mass.

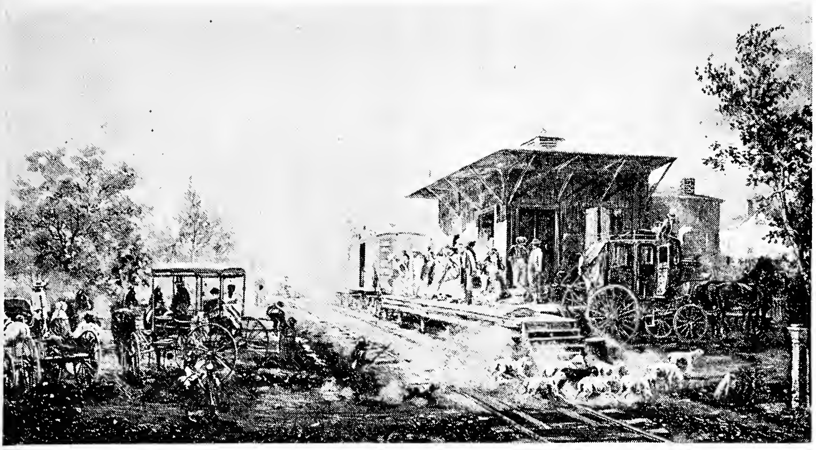


Figure 108 *Station on "Morris and Essex Railroad,"* 1864: CAT. 44

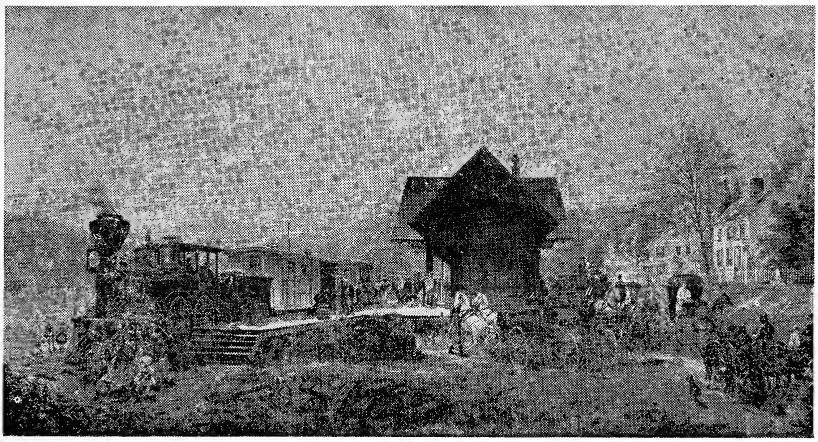


Figure 109 *The 9.45 A.M. Accommodation, Stratford, Connecticut,* 1867: CAT. 65. Collection, Metropolitan Museum of Art. (Photograph courtesy Metropolitan Museum of Art)

Figure 110 *Old Dutch Church, New York*, 1869: CAT. 83. Collection, Metropolitan Museum of Art. (Photograph courtesy, Metropolitan Museum of Art)

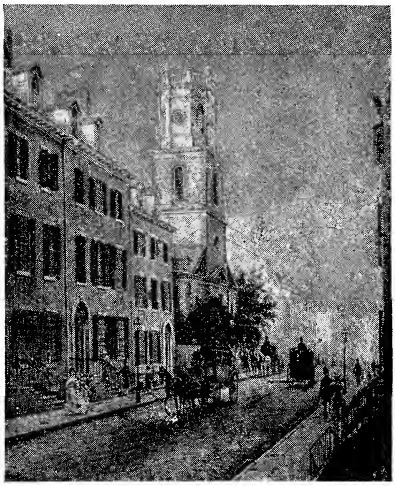


Figure 111 *St George's Chapel, Beekman and Cliff Street, New York*, 1875: CAT. 119. Collection, Metropolitan Museum of Art. (Photograph courtesy, Metropolitan Museum of Art)

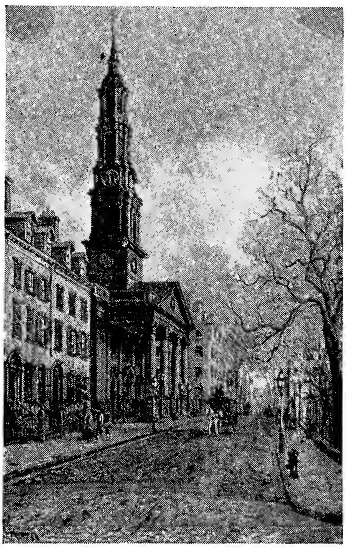


Figure 112 *St John's Church, Varick Street, New York, 1866*, 1868: CAT. 79. Collection, Macbeth Galleries

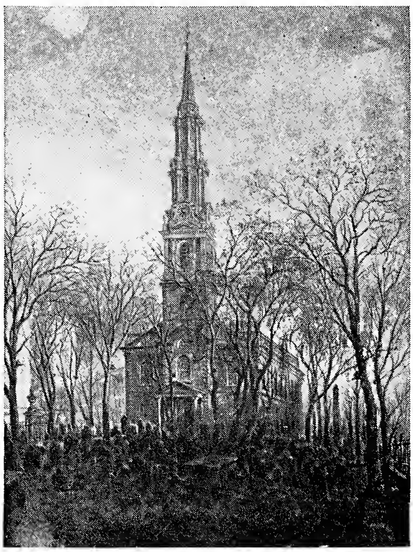


Figure 113 *St Paul's Church, 1766;* 1868: CAT. 80. Collection, Macbeth Galleries

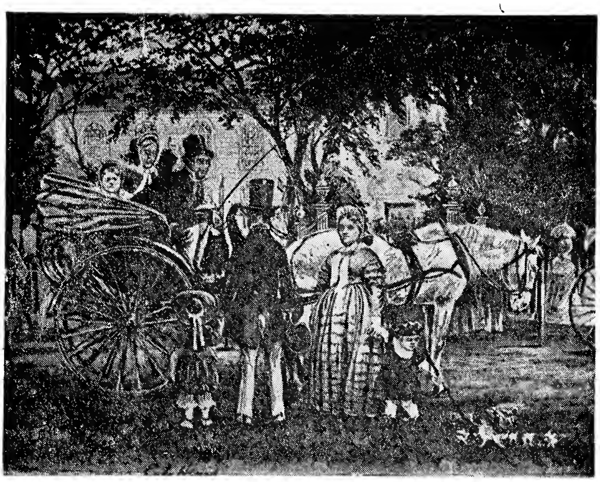


Figure 114 *A Chat After Meeting,* 1868: CAT. 77

Figure 115 *Alt Kirche, Oberammergau,* 1872: CAT. 100

Figure 116 *The Doctor,* 1873: CAT. 105. Collection, Estate of Francis P. Garvan

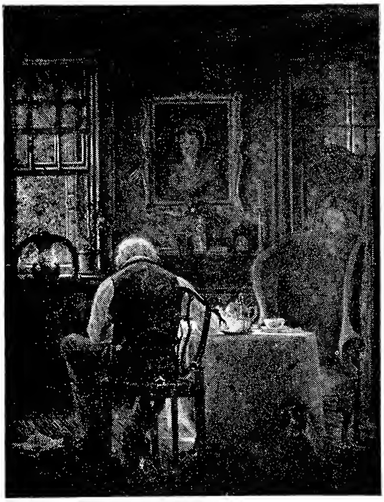


Figure 117 *The Widower,* (1873 ?): CAT. 106. Collection, Estate of Francis P. Garvan

Figure 118 *A Quiet Corner by the Door,* 1873: CAT. 107. A photograph, colored, is in the Henry Collection, New York State Museum

Figure 119 *The Old Paternal Home,* 1874: CAT. 110. Mabel Brady Garvan Collection, Yale University Art Gallery

Figure 120 *Les Fosses Communes,* 1876: CAT. 128-*a.* Collection, New York State Museum

Figure 121 *Les Fosses Communes, Cimitiere de St Owen, Paris,* 1876: CAT. 128. Collection, New York State Museum

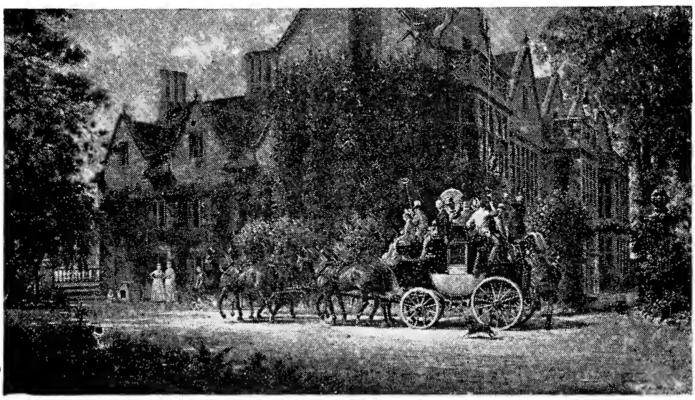


Figure 122 *Off for the Races,* 1876: CAT. 124. Collection, Estate of Francis P. Garvan

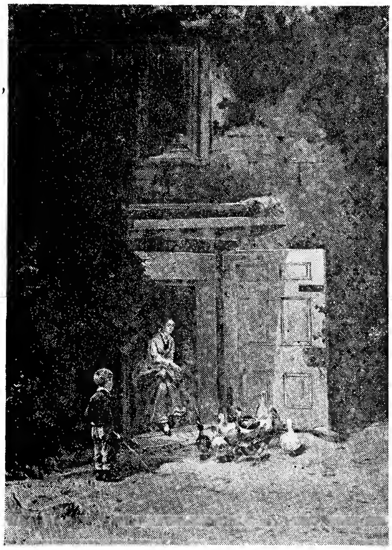


Figure 123 [*Feeding the Ducks*], [1876]: CAT. 125. Collection, New York State Museum

Figure 124 [*Taking a Rest*], [1888]: CAT. 204. Collection, New York State Museum

Figure 125 *Departure of the Brighton Coach,* 1878: CAT. 136

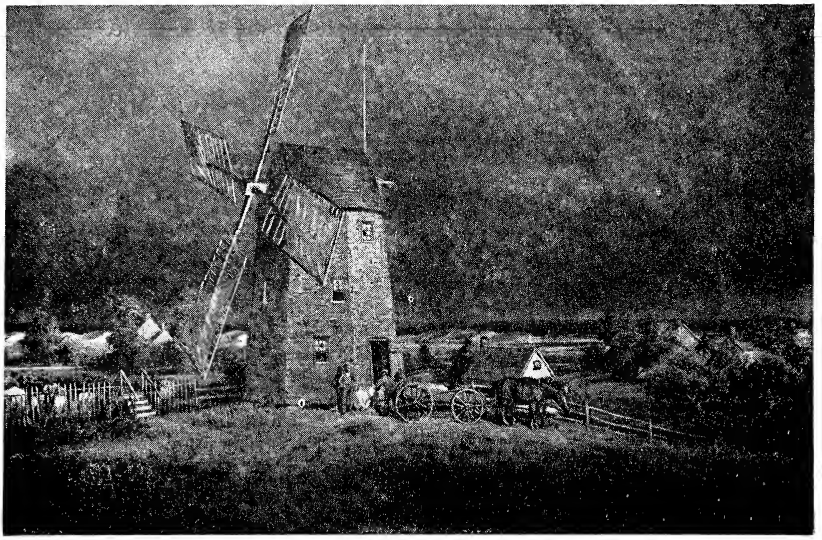


Figure 126 *Old Hook Mill, East Hampton,* 1881: CAT. 151. Collection, Mrs Francis P. Garvan sr.

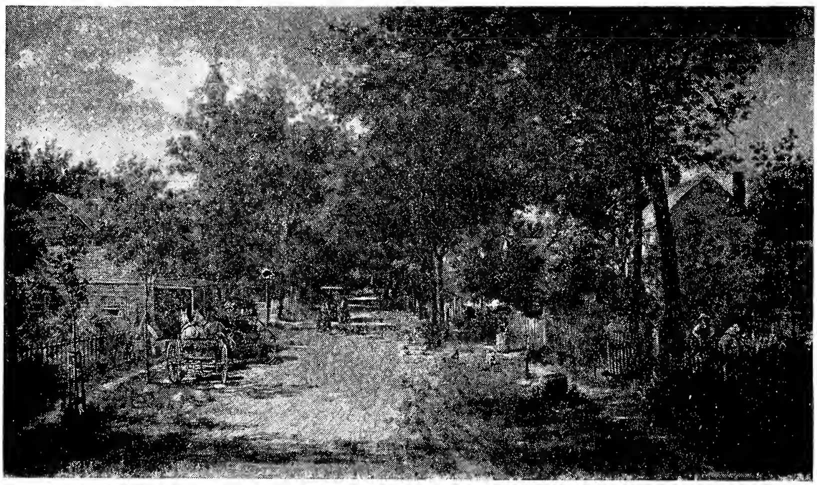


Figure 127 *The Country Store,* 1885: CAT. 181. Collection, Estate of Francis P. Garvan

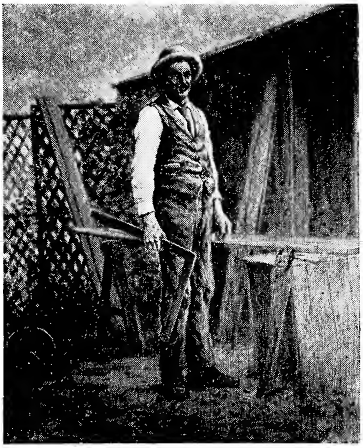


Figure 128 *Joseph E. Mance*, [1887 ?]: CAT. 193. Collection, Village of Ellenville. (Photograph copyright, Village of Ellenville)

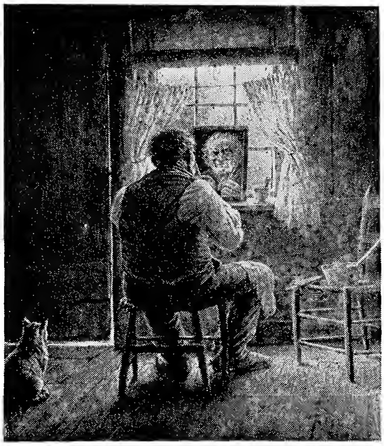


Figure 129 *Peter Brown*, 1886: CAT. 187. Collection, Village of Ellenville. (Photograph copyright, Village of Ellenville)

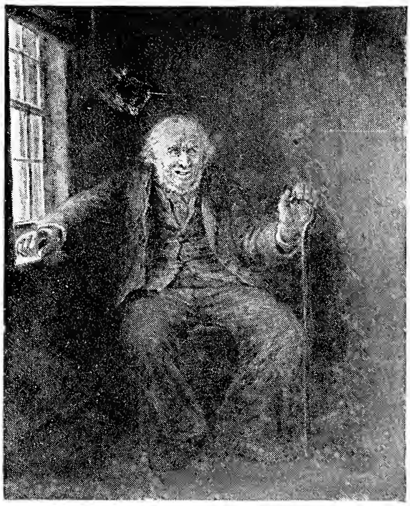


Figure 130 *Martin Terwilliger*, [1886]: CAT. 188. Collection, Village of Ellenville. (Photograph copyright, Village of Ellenville)

Figure 131 *Fred Thomas alias Black Fred*, 1887: CAT. 194. Collection, village of Ellenville. (Photograph copyright, Village of Ellenville)

Figure 132 *Nelly Bloomer*, 1890: CAT. 230. Collection, Village of Ellenville. (Photograph copyright, Village of Ellenville)

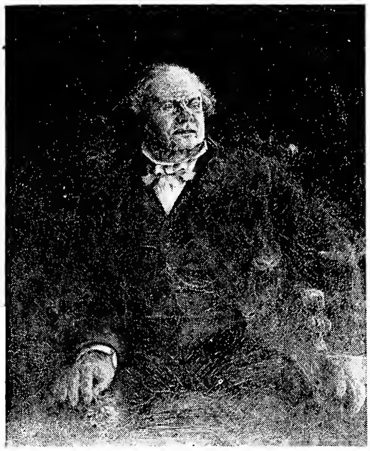


Figure 133 *John S. Billings*, 1883: CAT. 167. Collection, Village of Ellenville. (Photograph copyright, Village of Ellenville)

Figure 134 A snapshot of Joseph E. Mance, the gift of his son, S. D. Mance of Ellenville

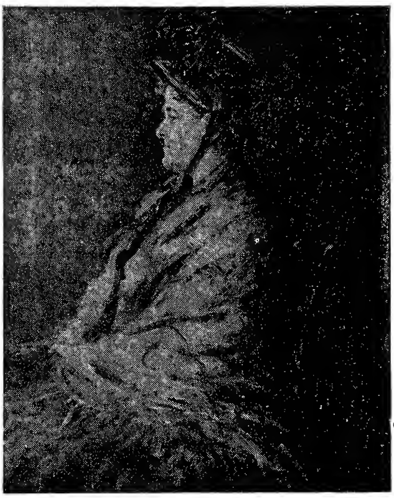


Figure 135 *Mrs Nancy Evans*, 1896: CAT. 270. Collection, Harry M. Bland

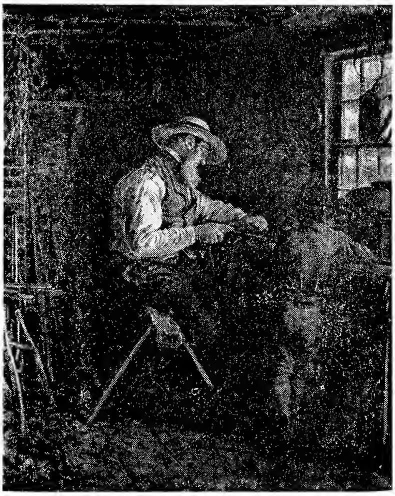


Figure 136 *Sharpening the Saw*, [1887 ?]: CAT. 195. Collection, New York State Historical Association

Figure 137 *A Mountain Road*, 1881: CAT. 153

Figure 138 *Bracing Up*, 1883: CAT. 168

Figure 139 *A Hard Road to Travel*, 1882: CAT. 162. Collection, Mrs Harcourt Wesson Bull

Figure 140 *Reading the Story of Bluebeard,* [1880 ?]: CAT. 145

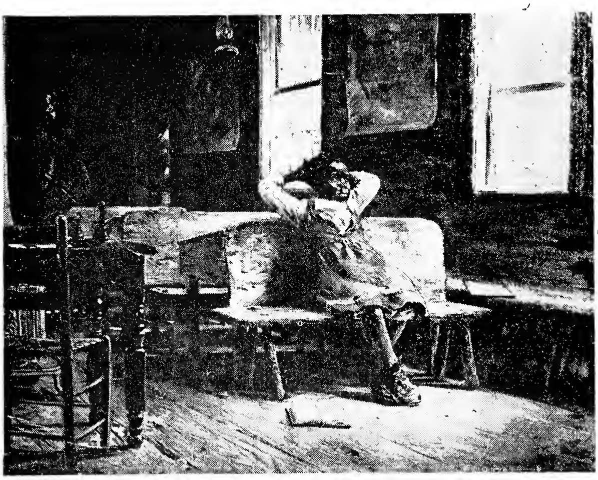


Figure 141 *Kept In,* 1888: CAT. 205

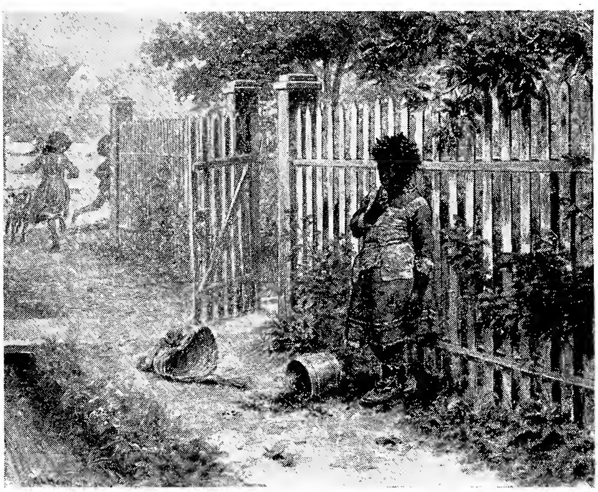


Figure 142 *Meditating Revenge,* 1892: CAT. 255

Figure 143 *Uninvited Guests,* 1883: CAT. 169

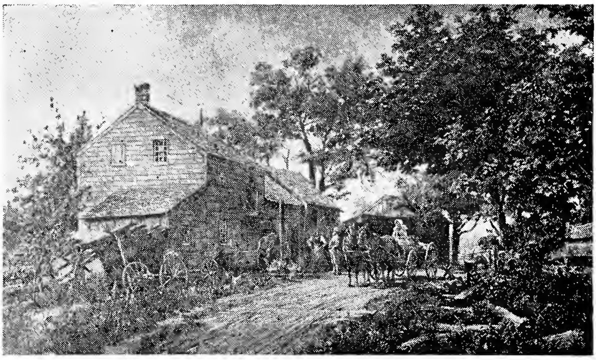


Figure 144 *The Old Forge,* [1887 ?]: CAT. 200

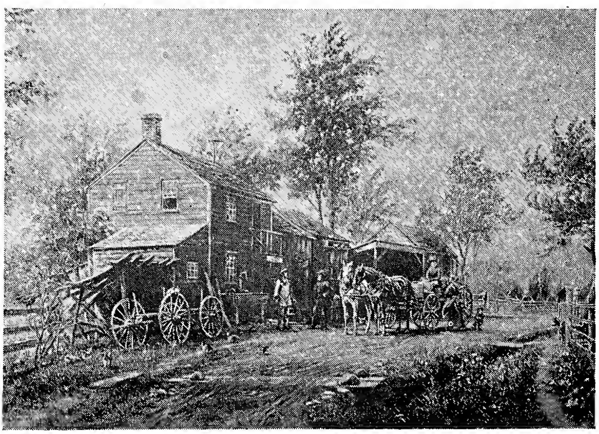


Figure 145 *The Country Carpenter,* 1890: CAT. 234

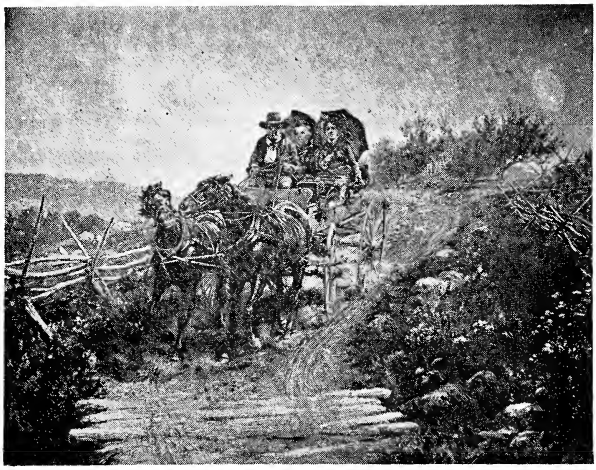


Figure 146 *The Summer Boarders,* 1881: CAT. 152. Collection, Martin E. Albert

Figure 147 *"School's Out," Below Cragsmoor, N. Y.,* 1887: CAT. 199. Compare with figure 20, **in** which this painting may be seen on the wall

Figure 148 *A Country Doctor,* 1886: CAT. 189

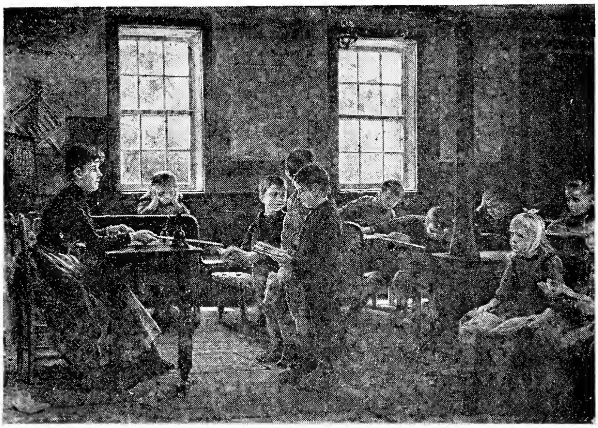


Figure 149 *A Country School,* 1890: CAT. 232. Collection, Estate of Francis P. Garvan

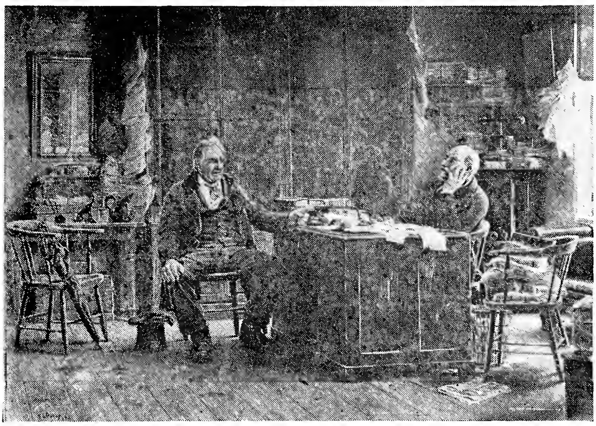


Figure 150 *A Country Lawyer,* 1895: CAT. 264

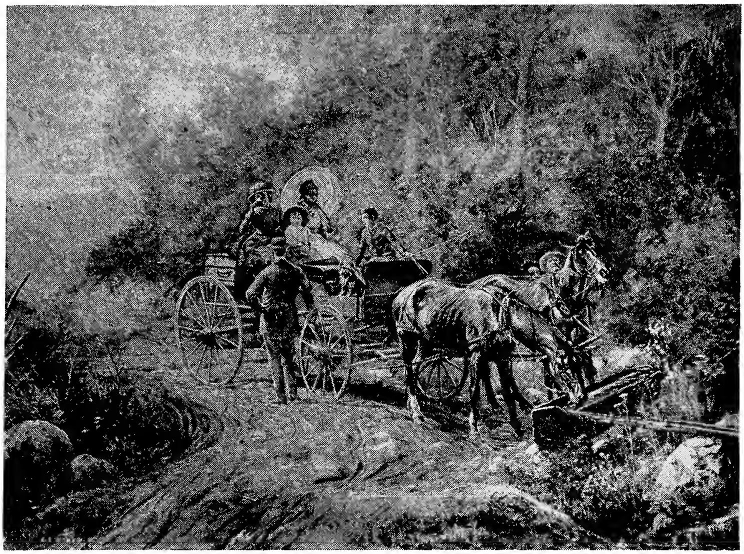


Figure 151 *The Watering Trough,* 1884: CAT. 179

Figure 152 *Thanksgiving Sleigh Ride,* 1886: CAT. 191

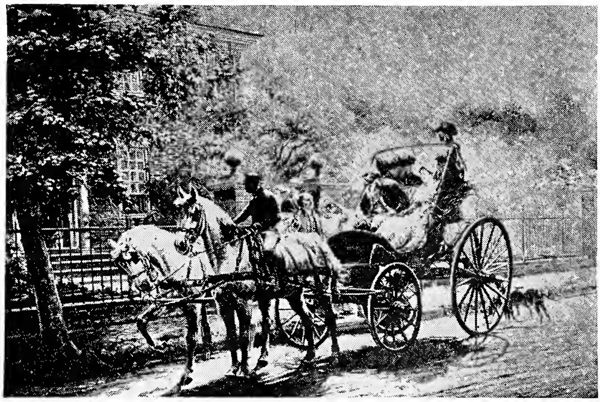


Figure 153 *One Hundred Years Ago,* 1887: CAT. 198

Figure 154 *A Temperance Preacher,* 1888: CAT. 212

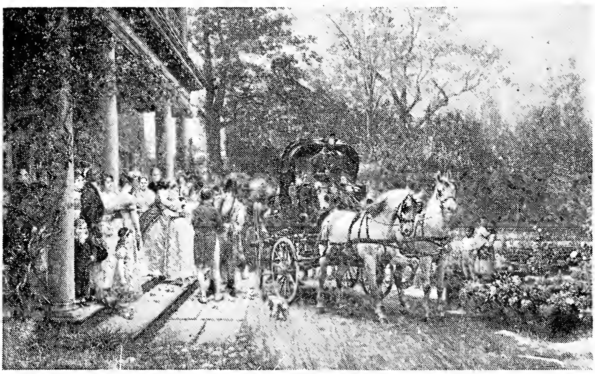


Figure 155 *A Virginia Wedding,* 1890: CAT. 231. Collection, Estate of Francis P. Garvan

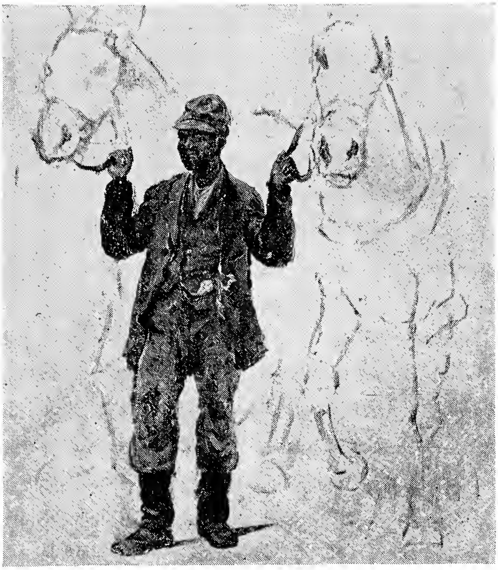


Figure 156 *Negro Stableboy:* CAT. 1057. Used as a detail for figure 157. Collection, New York State Museum

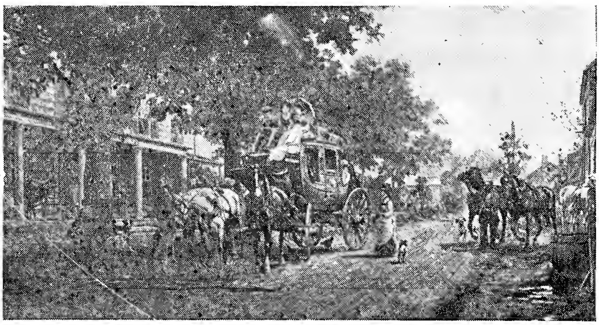


Figure 157 *The Relay,* 1881: CAT. 156

Figure 158 *The Arrival of the Stage,* 1904: CAT. 316. Collection, Estate of Francis P. Garvan

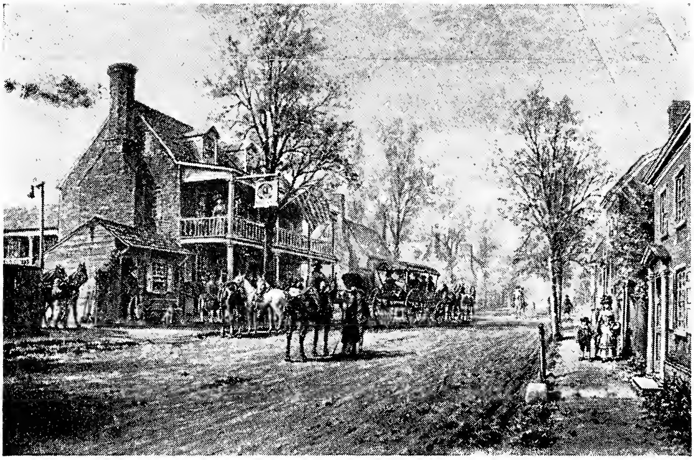


Figure 159 *Indian Queen Inn, Bladensburg, Md.* 1899: CAT. 290

Figure 160 *Changing Horses,* 1905: CAT. 327

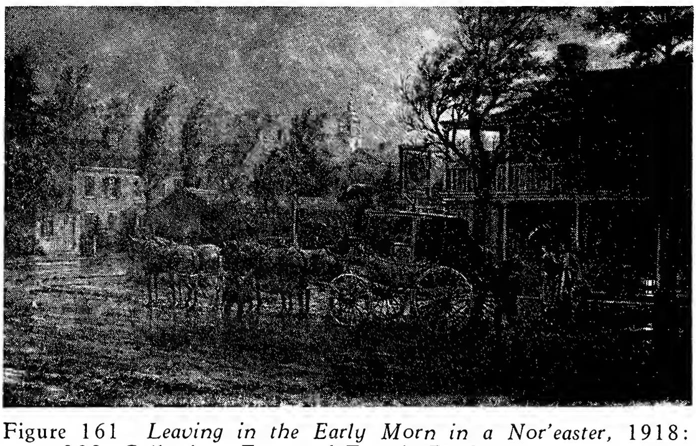


Figure 161 *Leaving in the Early Morn in a Nor'easter,* 1918: CAT. 388. Collection, Estate of Francis P. Garvan

Figure 162 *The First Railway Train on the Mohawk and Hudson Road,* 1892–93: CAT. 257. This photograph is a copy of the Klackner print, copyrighted in 1894. Collection, Albany Institute of History and Art

Figure 163 *Waiting for the New York Boat, Stonington, Conn., the First Railroad from Stonington to Boston,* 1905: CAT. 329

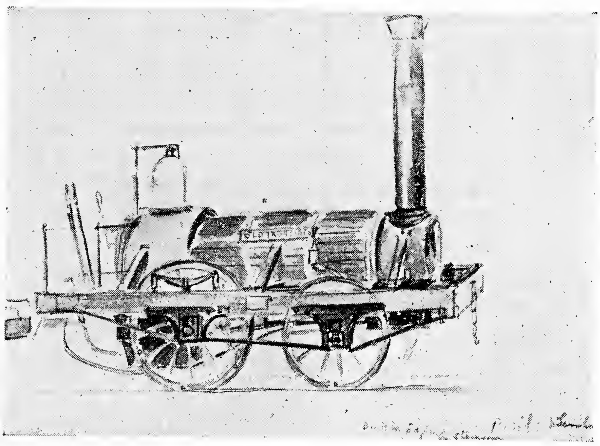


Figure 164 "Built in England by Stevenson." A drawing in Sketchbook 24: CAT. 1208. Collection, New York State Museum

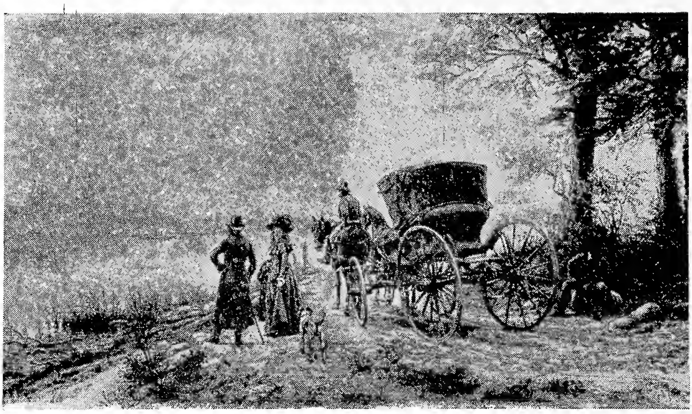


Figure 165 *Waiting at the Ferry,* 1899: CAT. 287

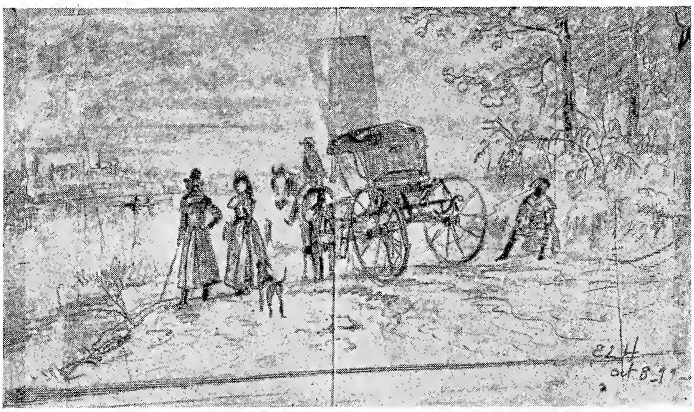


Figure 166 *Waiting at the Ferry,* 1899: CAT. 287-*a.* A drawing used as a detail for figure 165. Collection, New York State Museum

Figure 167 *Crossing the Ferry,* 1893: CAT. 288-*a.* Compare also with CAT. 288. Collection, Mrs Frank E. Miller

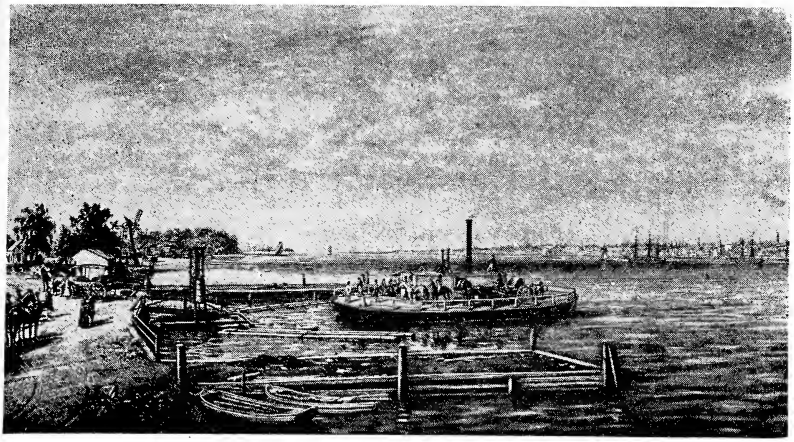


Figure 168 *Fulton's First Steam Ferryboat, Running from Cortlandt Street to Paulus Hook, Jersey City, 1813–14,* [1901]: CAT. 304

Figure 169 *Waiting at the Ferry,* (1899): CAT. 1088. A sketch in oil on wood used as a detail for figure 165. Collection, New York State Museum

Figure 170 *The Tow Path,* 1891: CAT. 249

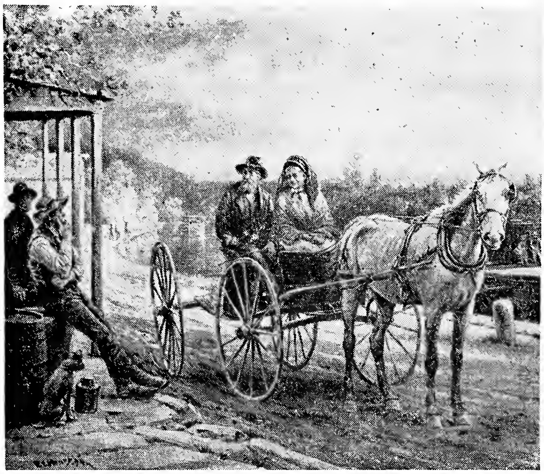


Figure 171 *Late Afternoon on the Old Delaware and Hudson Canal at Port Ben, N. Y.,* 1894: CAT. 261. Mabel Brady Garvan Collection, Yale University Art Gallery

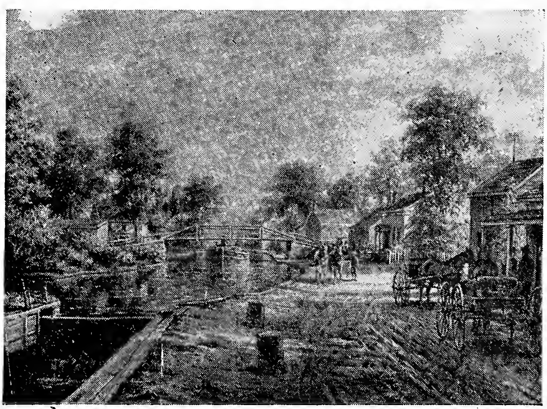


Figure 172 *Scene Along the Delaware and Hudson Canal,* 1907: CAT. 342

Figure 173 *On the Tow Path, 1:* CAT. 1146. Collection, New York State Museum

Figure 174 *On the Tow Path, 3:* CAT. 1148. Collection, New York State Museum

Figure 175 *On The Tow Path, 2:* CAT. 1147. Collection, New York State Museum

Figure 176 *On the Tow Path, 4:* CAT. 1149. Collection, New York State Museum

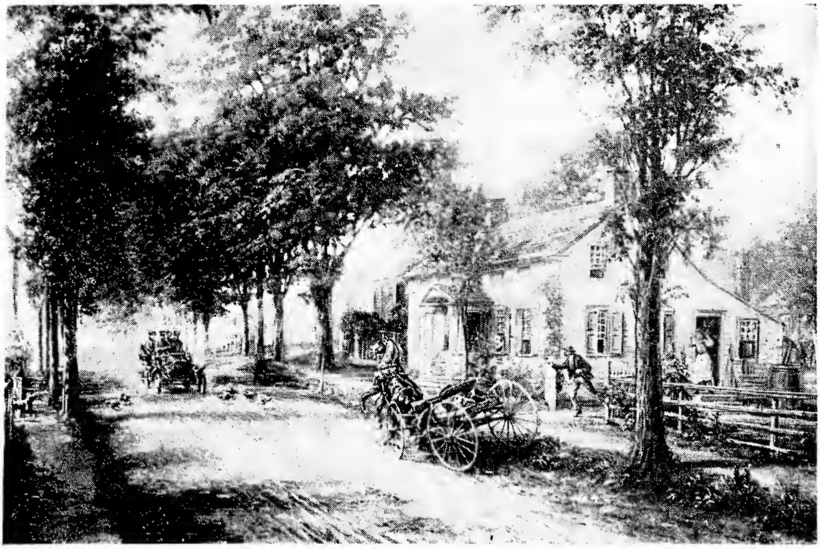


Figure 177 *A Disturber of the Peace,* 1905: CAT. 326

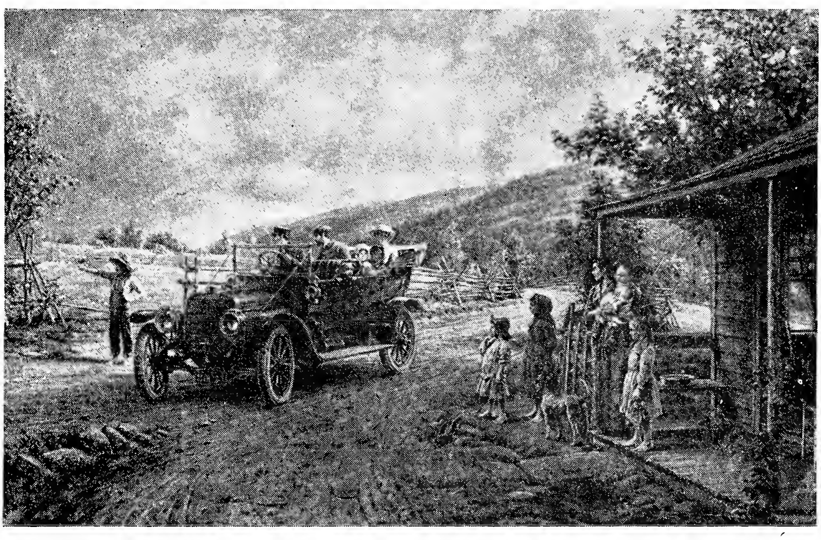


Figure 178 *Contrasts,* 1914: CAT. 371. Collection. Albert Duveen

Figure 179 *The New Woman,* [1892 ?]: CAT. 253

Figure 180 *Early Autumn,* 1906: CAT. 338

Figure 181 *The Gossips,* 1908: CAT. 349

Figure 182 *The County Fair,* 1891: CAT. 246

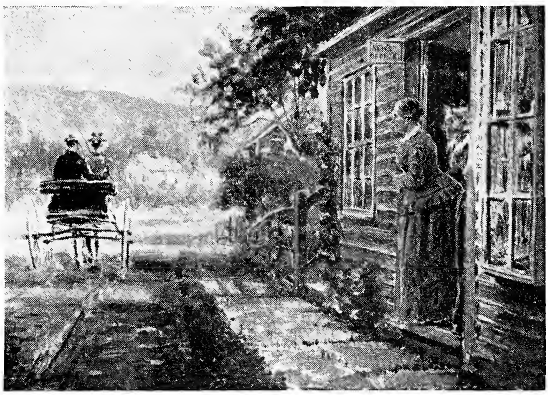


Figure 183 [*News Office*], [1894 ?]: CAT. 263.

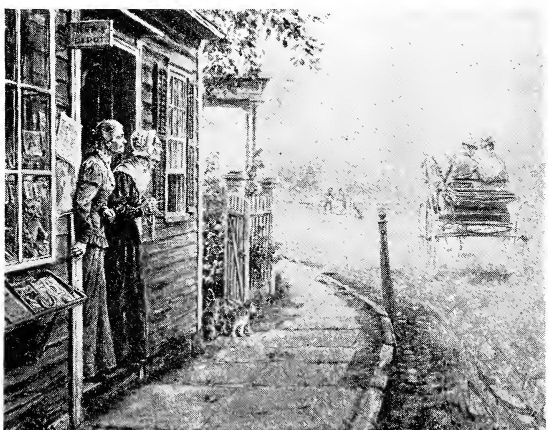


Figure 184 *Food for Scandal,* 1907: CAT. 343

Figure 185 *Passing the Outposts,* 1903: CAT. 309

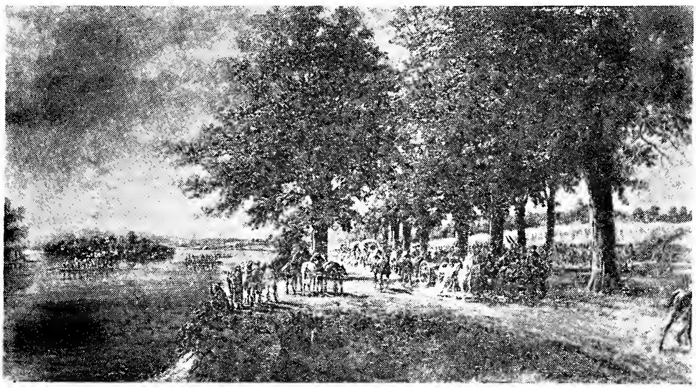


Figure 186 *Burgoyne's Army on the March to Saratoga, September, 1777,* [1902 ?]: CAT. 306

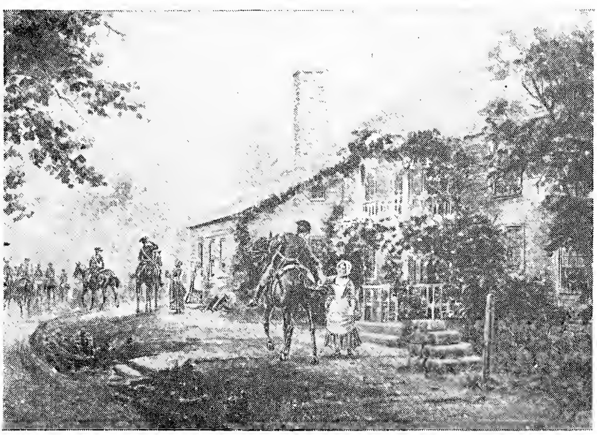


Figure 187 *Good-Bye, Sweetheart,* 1900: CAT. 300

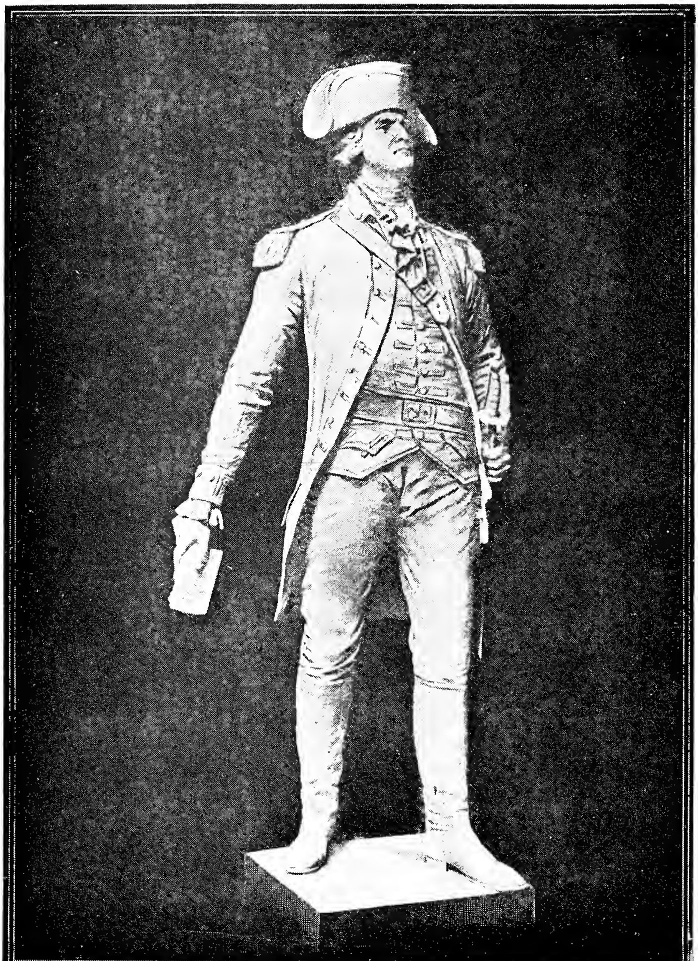


Figure 188 Statue of General Gansevoort, 1906: CAT. 1217. Designed by Henry and presented to the City of Rome by Catherine Gansevoort Lansing of Albany

Appendix to the Catalog

Titles which have been located since the completion of the catalog in 1942 are entered in this appendix, being designated by *A* followed by the number of the catalog entry they should succeed (as *A-57*), to distinguish them from catalog entries of collateral items already designated by *a* which follow the catalog number (as *244-a*).

A-57 THE RAINBOW 1865
Oil on canvas, 8x12 in.
Lower right: *E L H '65*
Exhibitions: Century Association, 1942, NO. 44

A-64 CANAL STREET, NEW YORK, 1830 1867
Oil on cardboard, 11x10½ in.
Lower right: *E L Henry '67*
Collection: E. Mortimer Barnes

A-105 STATION AT ORANGE, N. J. 1873
Oil on academy board, 11x19 in.
Lower left: *E L Henry '73*
Collection: E. Mortimer Barnes

A-106 THE GOVERNOR GOES TO THE FARM *c.* 1873
Oil on canvas, 8x7½ in.
Lower right: *E L Henry*
Exhibitions: Century Association, 1942, NO. 14
Collection: Mrs Frederic Frazier

A-108 OLD CHURCH
Oil on board, 5½x3¾ in. 1873
Lower right: *E L H '73*
Exhibitions: Century Association, 1942, NO. 35
Collection: Macbeth Gallery

A-110 SKETCH AFTER NATURE, SEPTEMBER 30 1874
Oil on canvas, 10x14½ in.
Lower right: *E L Henry 1874*
Exhibitions: Century Association, 1942, NO. 53
Collection: Douthitt Galleries

A-119 RESIDENCE OF DUDLEY S. GREGORY 1875
Oil on canvas, 16x28 in.
Lower right: *E L Henry 1875*
Exhibitions: Century Association, 1942, NO. 45
Collection: Mrs Ernest Tyler

A-126 WARWICK FROM ST. JOHN'S PRIORY 1876
——, 11¾x19¾ in. (inside mat)
Lower right: *Warwick from St. John's Priory*
E. L. Henry 1876
Collection: Juanita A. Almirall

Miss Almirall has supplied the above information and gives the following text of an inscription, location not stated:

A study from nature of Warwick, England from the Gate House of St. John's. St. Mary's is seen at the right, at the left in the distance is the Norman Tower of Warwick Castle. Made in July 1876.

A-143 KING OF THE MONTAUKS 1880
Oil on canvas, 12x16 in.
Lower right: *E L Henry '80*
East Hampton, L. I.
Exhibitions: Century Association, 1942, NO. 22
Cf. Prince of the Mohawk CAT. 952

A-197 A STUDY NEAR PETERSBURG, VA. *c.* 1887
Oil on canvas, 12½ x21 in.
Lower left: *E L Henry,* and as above
Collection: E. Mortimer Barnes

A-222 MARRIAGE IN THE OLDEN TIME *c.* 1889
The only datum is a reference in a letter dated December 27, 1889.

A-229 IN THE GARDEN *c.* 1889
Water color on paper, 6⅞ x4⅞ in.
Lower left: *E L Henry*
Exhibitions: Century Association, 1942, NO. 18
Collection: Macbeth Gallery

A-238 THE DOCTOR'S BUGGY *c.* 1890
Oil on canvas, 12½ x17 in.
Lower left: *E L Henry*
Collection: E. Mortimer Barnes

A-240 COUNTRY POST OFFICE, EAST TENNESSEE *c.* 1890
Water color on paper, 5½ x8¼ in.
Lower left: *E L Henry*
Exhibitions: Century Association, 1942, NO. 6
Collection: Arthur Lasslow

A-241 HAPPY-GO-LUCKY *c.* 1890
Oil on wood panel, 10½ x7⅜ in.
Lower left: *E L Henry*
Collection: Guy Mayer Gallery
Figure 260

A-244 A MOMENT OF TERROR
KL. NO. 32

A-258 THE MESSAGE 1893
Oil on board, 10x14 in.
Lower right: *E L Henry '93*
Exhibitions: Century Association, 1942, NO. 28
Collection: Gilbert Gabriel

This painting was given to its present owner by William Beers Crowell, whose mother was a daughter of one of the Beers brothers who did framing for Henry.

The painting seems to be related to [*Mrs Henry in a Buckboard*] CAT. 209.

A-293 A RAINY DAY *c.* 1899
The only datum is a reference in Henry's 1899 diary.

A-294 SATURDAY MORNING *c.* 1899
The only datum is a reference in Henry's 1899 diary.

A-303 HOME FROM THE WAR *c.* 1900
The only datum is the copyright application, dated February 12, 1903. For date attributed here, see NOS. 295 and 303.

Included in the Century Association exhibition, April 7 to May 9, 1942, was a water color and crayon drawing on paper, 15 by 23½ inches, NO. 46, entitled *Return from the Wars.* Could this be the above unidentified picture?

A-304 OLD NEW YORK 1901

Water color on paper, 13x21 in.
Lower right: *E L Henry 1901*
Exhibitions: Century Association, 1942, NO. 36
Collection: Douthitt Galleries
Inscribed on back: *The first brick house built in America*

A-354 ST. JOHN'S CHAPEL, VARICK STREET, NEW YORK CITY 1909

Oil on ——, 21 15/16x20 12/16 in. (inside frame)
Lower left: *E. L. Henry – 1909*
Collection: Juanita A. Almirall
Miss Almirall has supplied the above data.

A-355 A SUNSET PAINTED FROM NATURE AT CRAGSMOOR 1909

Oil on ——, 15⅞x19⅝ in. (inside frame)
Lower right: *E. L. Henry – 1909*
Collection: Juanita A. Almirall

Miss Almirall has supplied the above information and gives the following text of an inscription, location not stated:

A sunset painted from nature at Cragsmoor on the Shawangunk mountains overlooking the Roundout Valley and the distant Alleghanies [sic!] *in Eastern Pennsylvania. Painted from studies made of the sunset the next morning by*

E. L. Henry
Summer of 1909

Miss Almirall's letter adds that this painting received honorable mention at the 1909 winter exhibition of the National Academy of Design.

A-372 COUNTRY LANDSCAPE c. 1914

Oil on canvas, 18x30 in.
Lower right: *E L Henry*
Exhibitions: Century Association, 1942, NO. 5
Collection: Joseph A. Muller

A-388 [THE OLD LOCK BELOW ELLENVILLE] 1918

——, 9⅜x12⅝ in. (inside frame)
Lower right: *E. L. Henry – 1918*
Collection: Juanita A. Almirall

Miss Almirall has supplied the above information and gives the following text of an inscription, location not stated:

This picture was made from a study from nature at this old lock just below Ellenville in the nineties at the old "Delaware and Hudson Canal" which ran from Honesdale, Pennsylvania, in the coal mining district to Rhinebeck-on-the-Hudson. It supplied coal all along the whole route plentifully and cheap and brought up freight even from New York City. J. P. Morgan came up from New York City and seeing that the canal interfered with the revenue of the new Ellenville and Kingston Railroad, purchased it and had it destroyed, to the regret of the whole valley.

Miss Almirall's letter adds that this is Henry's last completed picture.
Cf. NO. 249

A-907 THE BROOKS POST OFFICE, STRATFORD, CONN.

Oil on canvas, 11x13 in.
Exhibitions: Century Association, 1942, NO. 3
Collection: Charles Wellington Walker

A-910 COLONIAL WEDDING
The only datum is a reference in the MS., p. 331, 335

A-911 COUNTRY LANE
Bibliography: Parke-Bernet catalog, February 10–11, 1939, NO. 91

A-912 COUNTRY WEDDING
The only datum is a reference in the MS., p. 331

A-919 FOOT OF EAST BROAD STREET, STRATFORD, CONN.
Oil on canvas, 14x20 in.
Exhibitions: Century Association, 1942, NO. 12
Collection: Charles Wellington Walker

A-925 INDIAN ENCAMPMENT
Oil on canvas, 7x10½ in.
Exhibitions: Century Association, 1942, NO. 17

A-932 KITCHEN OF FRAU JUDAS .
Oil on paper, 10x8¾ in.
Lower right: *E L H* (enry), [the latter added in another hand]
Sept. 11
Collection: Joseph P. Hartert

A-976 THE WEDDING DAY
Exhibitions: World's Columbian Exposition, Chicago, 1893, NO. 551
Collection: "Mr. Dickinson, Holyoke, Mass."

A-1101–07 **The Gift of Mr and Mrs Charles H. Peters, of Cragsmoor, includes two sketches in oil on canvas not listed in the catalog proper.**

A-1108–33 **The gift of Mr and Mrs Charles H. Peters, of Cragsmoor, includes several sketches in oil on paper not listed in the catalog proper.**

A-1160–84 **The gift of Mr and Mrs Charles H. Peters, of Cragsmoor, includes a number of pencil drawings on paper not listed in the catalog proper. Among these may be noted the following:**

(1) St. Erasme, Gaeta. 9¾x7¼ in. Apparently a drawing for NO. 56, an unlocated painting.
(2) A sketch for *The 9.45 A.M. Accommodation,* NO. 65, measuring 5¼x9 in. There are in the Peters gift two other drawings of railroad station scenes, which seem related.
(3) Sketch, 8¼x10 in., for *The Temperance Preacher,* NO. 212.
(4) Sketch, 10x14 in., for *A Virginia Wedding,* NO. 231.
(5) Sketch, 7½x11 in., of Gen Gansevoort's gig, with the initial "G" in a circle.
(6) Several sketches of horses, related to details reproduced in report. *Cf.* Figs. 173–76.
(7) Sketch, 9½x6 in., of Negro girl standing in listening pose: a detail for [*Maud Powell Plays the Violin*], NO. 319, Fig. 71.
(8) Sketch, 13⅞x9⅞ in., pencil with colored crayon. This drawing shows a woman sitting in a window alcove, reading. It is interesting because it documents Henry's attention to detail and shows how carefully he worked.
(9) Sketch, 7¼x5¾ in., showing a religious procession in a French church led by the *bedeau* with halberd and mace. Was this a note for a French subject which has not come to light? *Cf.* NOS. 128 and 128-*a*, Figs. 120 and 121.

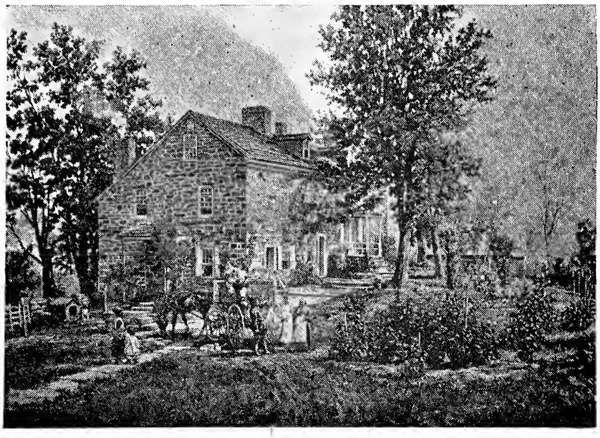


Figure 189 *The Pedler,* 1879: CAT. 139. Collection, William B. Kirkham

Figure 190 *A One-Sided Bargain,* 1902: CAT. 305. Collection, Estate of Francis P. Garvan

Figure 191 *The Village Huckster,* 1913: CAT. 367

Figure 192 *Testing His Age,* [1892 ?]: CAT. 254

Figure 193 *The Huckster,* 1914: CAT. 370. Collection, I. Snyderman

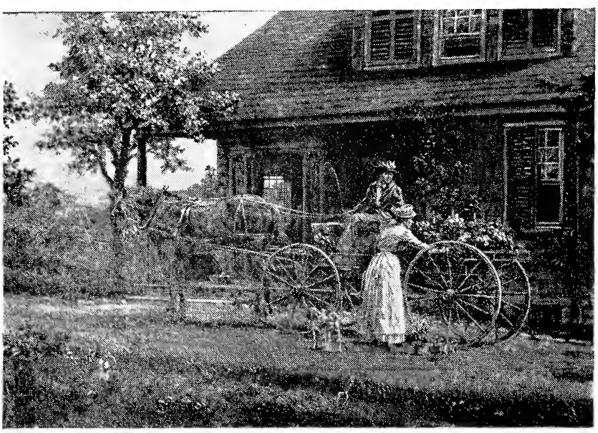


Figure 194 *The Flower Seller,* 1906: CAT. 335

Figure 195 *Testing His Age,* [1892 ?]: CAT. 254-*a*. A detail for figure 192. Collection, New York State Museum

Figure 196 *Horse and Pedler's Wagon:* CAT. 1148. A detail for figure 193. Collection, New York State Museum

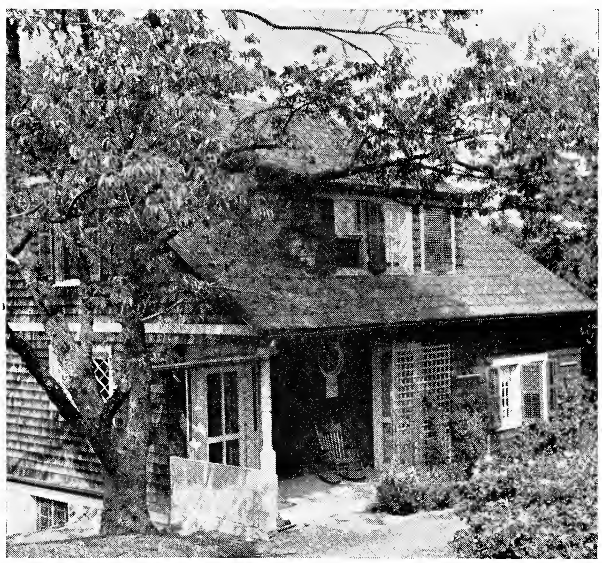


Figure 197 The Husson-Buxton Cottage at Cragsmoor, formerly owned by the Henrys, seen in figure 194, as it looked in 1941

Figure 198 *Forgotten,* 1894: CAT. 376-*a.* A detail for figure 199. Collection, New York State Museum

Figure 199 *Out in the Storm,* 1916: CAT. 376

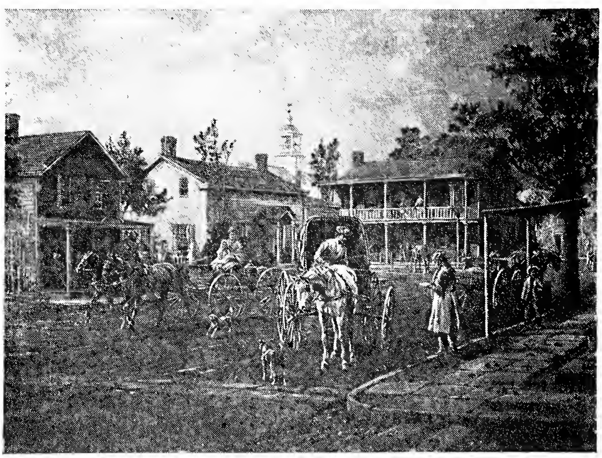


Figure 200 *A Village Street,* 1916: CAT. 378

Figure 201 The Cragsmoor Post Office, 1941. Seen in figure 202

Figure 202 *An October Day,* 1903: CAT. 308. Collection, Martin E. Albert

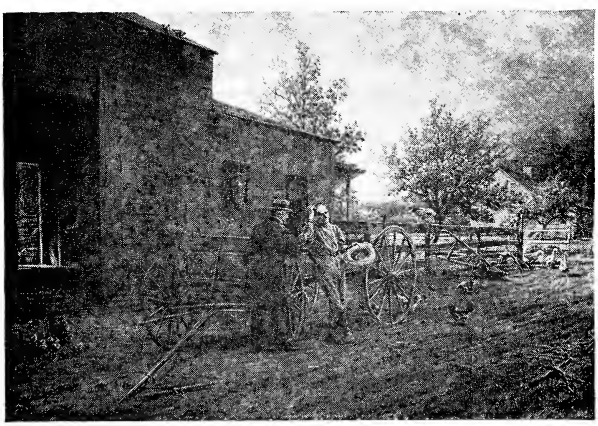


Figure 203 *The Bill Collector,* 1913: CAT. 365. Collection, Dr and Mrs H. M. Sassaman

Figure 204 *The Four Seasons—Spring,* 1914: CAT. 372-*1*. Collection, Albert Duveen

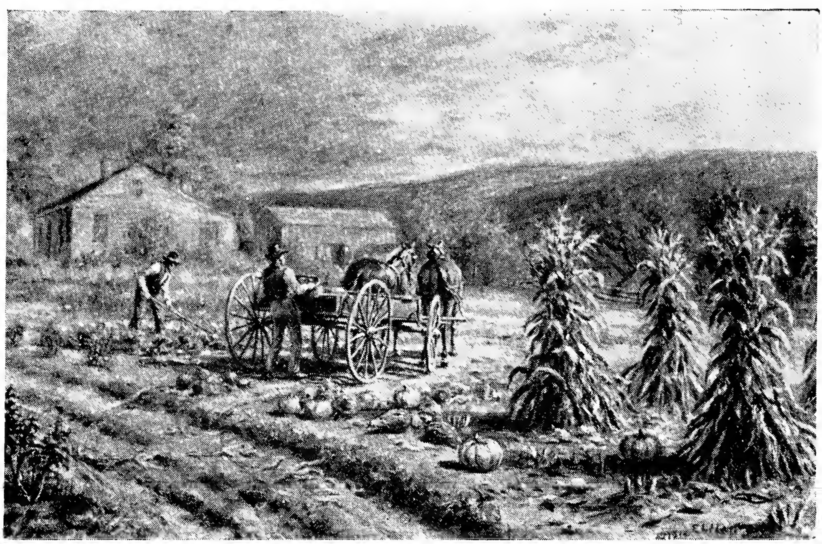


Figure 205 *The Four Seasons—Autumn,* 1914: CAT. 372-*3*. Collection, Albert Duveen

Figure 206 *The Four Seasons—Summer,* 1914: CAT. 372-*2.* Collection, Albert Duveen

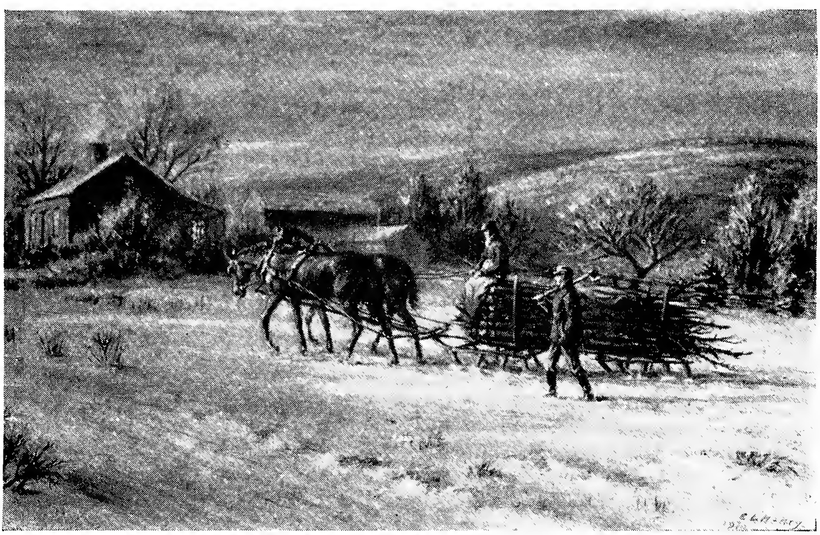


Figure 207 *The Four Seasons—Winter,* 1914: CAT. 372–*4.* Collection, Albert Duveen

Figure 208 *A Private View*, 1906: CAT. 334

Figure 209 *In East Tennessee*, 1906: CAT. 337

Figure 210 *The Uplands at Bow*, 1914: CAT. 369. Collection, The First Church of Christ, Scientist, in Boston, Massachusetts

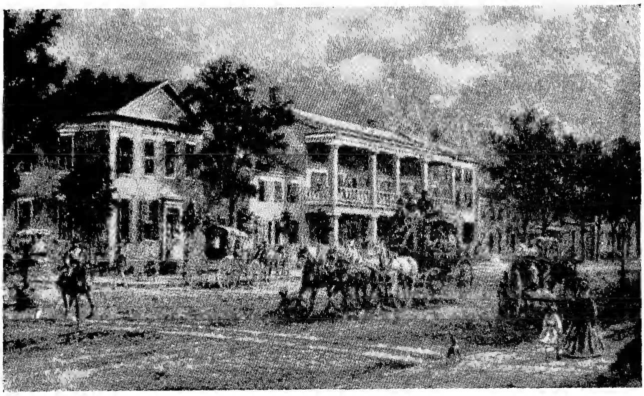


Figure 211 *Main Street in Johnstown, N. Y., in 1862,* 1916: CAT. 374. Collection, Mrs Charles B. Knox

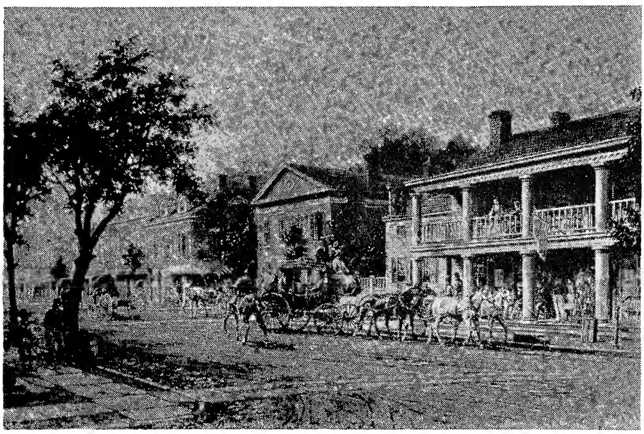


Figure 212 *Main Street, Johnstown,* 1917: CAT. 382

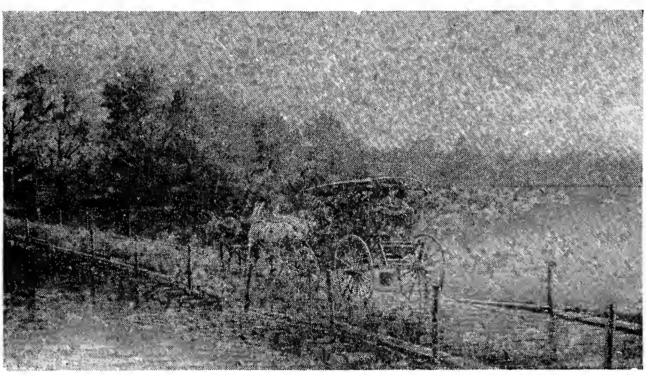


Figure 213 *The Floating Bridge,* 1917: CAT. 380. Collection, Mr and Mrs Arthur V. Hoornbeek. (Photograph courtesy, M. Knoedler and Company)

Figure 214 *The Old Clock on the Stairs*, 1917: CAT. 379. Collection, Ernest du Pont Meyrowitz. (Photograph courtesy, Ernest du Pont Meyrowitz)

Figure 215 *St Mark's in the Bowery*, 1917: CAT. 381. Collection, Martin E. Albert

Figure 216 *Waiting for the Stage,* [1918]: CAT. 387

Figure 217 *Waiting for the Stage,* 1872: CAT. 1089. A note for figure 216. Collection, New York State Museum

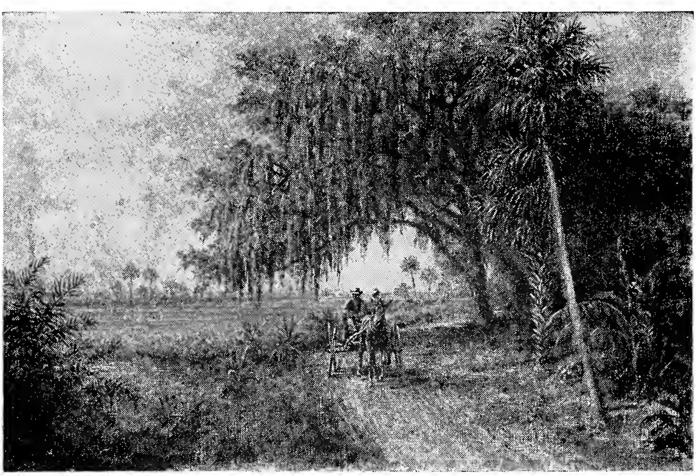


Figure 218 *Florida Landscape,* 1919: CAT. 391. A canvas left unfinished at Henry's death. Collection, New York State Museum

Figure 219 *Talking Politics,* 1900: CAT. 299

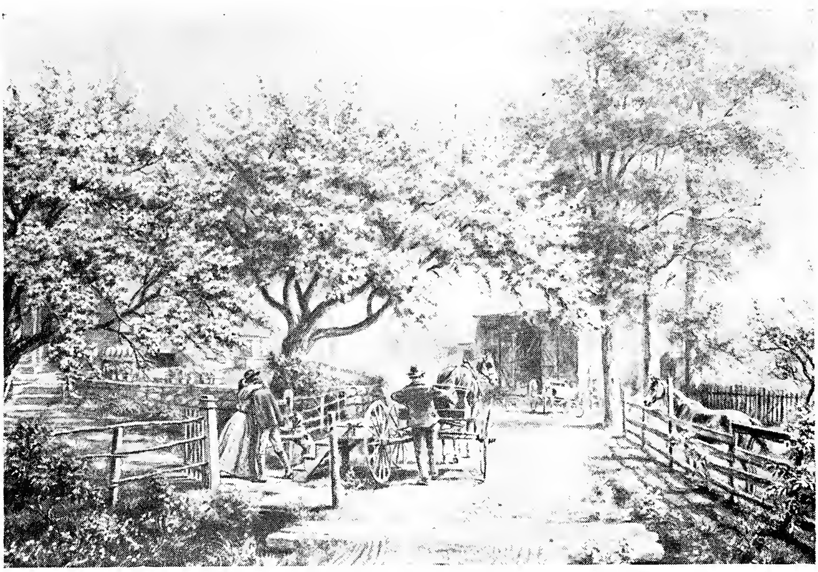


Figure 220 *Return from the Wars:* CAT. 956. Collection, Albert Duveen

Figure 221 *Colonial Doorway:* CAT. 1015. A detail for Nos. 110 and 116. Collection, New York State Museum. See figure 119

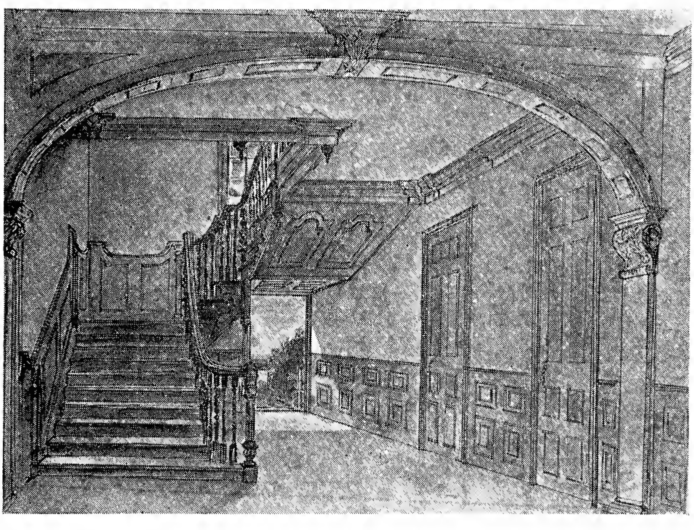


Figure 222 *Doorway:* CAT. 1020. A detail for No. 109. Collection, New York State Museum

Figure 223 *Negro Girl:* CAT. 1141. Compare with figure 124. Collection, New York State Museum

Figure 224 *The Lafayette Coach:* CAT. 1051. Compare with figure 75. Collection, New York State Museum

Figure 225 *Woman with a Basket:* CAT. 1099-*a*. Collection, New York State Museum, the gift of Charles C. Curran, N.A.

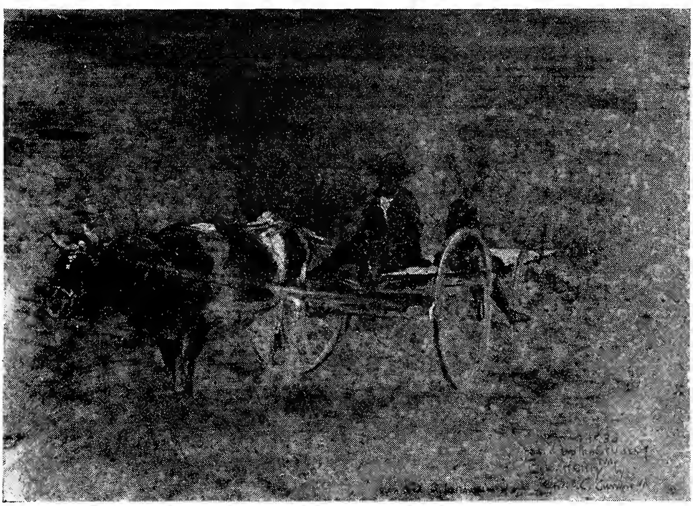


Figure 226 *Negro Boy and Girl on Oxcart:* CAT. 1055-*a*. Collection, New York State Museum, the gift of Charles C. Curran, N.A.

Figure 227 *Frances Livingston Wells (Henry)*, 1875: CAT. 117. The original is 6 x 5 inches, in a handsome shadow box. Collection, Albany Institute of History and Art.

A Memorial Sketch:

E. L. HENRY, N. A., His Life and His Life Work

BY FRANCES L. HENRY*

Dedication

I dedicate this sketch, written in loving memory of him, to all those patrons who cared for his paintings and all the dear friends who knew and loved him and who still care enough for him to read the simple and imperfectly written memoirs of his life and work. Although he has laid down brushes and paints, his lifework finished and well done, I hope he still lives in the hearts of these his friends. [1920–28]

F. L. H.

Childhood

People as a general thing seem to have a desire to know something of the private life of those whose work has brought them before the public, as it is often the inner life of one that counts as well as the more open, and I have been asked if I could not write some details of the life of my husband, Mr E. L. Henry, as nearly half a century of our life was spent together.

I have been asked; would I not tell something about the way he painted? How and where he found so many varied subjects of American life? Did he get his ideas from books? If so, what books? What he considered his most important work? These

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* The late Mrs Henry left her manuscript unfinished at her death in 1928. It has been edited for publication with a minimum of revision to keep the color of her style. Spelling and punctuation have been partially corrected for clarity, and the material has been arranged chronologically. Brackets [ ] indicate my additions to her text. Parentheses ( ) enclose references to this report.

Frances L. Henry died at Cragsmoor July 23, 1928, of angina pectoris, and was buried in the Johnstown cemetery with her husband. The Cragsmoor Echo of August 6, 1928, printed a memorial by Frederick S. Dellenbaugh, which states that she was born in Johnstown in 1845, of one of the oldest families in New York State. Dellenbaugh states that she went to New York to study art, which is erroneous, according to her niece, Mrs Stetson (McCausland '41). He adds, what is obviously true by Henry's portrait of her (CAT. 117; FIG. 227) that a prominent Academician, meeting the Henrys in Paris soon after their marriage, said Mrs Henry was one of the most beautiful women he had ever seen.

E. McC.

questions are constantly asked me, not only by friends, but also people have written me about paintings which they own, [asking] where and how they are painted?

I have portfolios of reproductions of his paintings and in trying to answer these questions by looking over them, I realize more and more what his life work was, and how everything centered in it. His large library of books, mostly Americana, travels, costumes and customs of the early American habits and life that our forefathers led, [was one evidence of his interest. Then he was always] searching through the country for their homes, sparing no pains or expense in getting all and everything that could help him make his work as perfect as possible; for he always felt and others often said, his paintings would live and be used as references long after he had gone. So, he wanted to make them as perfect and as true to the time they represented as was possible.

He had little if any care for foreign subjects although he has painted some. His great interest was historical as well as the simple country life of America. An article entitled "A Painter of the Good Old Times," (CL. '08) found in the Broadway Magazine of August, 1908, (Dunbar, '08) is so true of him that I am quoting from it.

> *"But each for the joy of working and each, in his separate star,*
> *Shall draw the Thing as he sees it for the God of*
> *Things as They Are!"*
>
> *. . . For "the Thing as he sees it" is the thing that he straight-forwardly paints, regardless of changing fads and fashions in art. All outdoors is full of beauty and of interest for him, and although he has chosen certain portions of it as his special province, he could set his canvas anywhere and be quite sure that either the face of nature or the life of man, or both together, would offer him a scene worth painting. Nor would he think it necessary to make changes in it in order to intensify its beauty or sentimental appeal. He sees the thing, exactly as it is, so full of beauty and of meaning and sentiment that to paint it with exact truth seems to be the full duty and the quite sufficient task of the artist. Nor does the question, "It's clever, but is it Art?" ever trouble him. Through all the years of a long and busy life he has been so occupied in transferring to canvas as much as he could of the everlasting beauty of the world that he has scarcely had time to consider whether this, that, or the other way of seeing or working is or is not art.*

[This quotation was edited by Mrs Henry. In the original, the second sentence from the end reads: "Nor does Kipling's Devil of the Workshop, the Mephistopheles of Art, with his age-old, deadening conundrum. 'It's clever, but is it Art!' ever whisper his paralyzing question in Mr Henry's ear." E. McC.]

He collected vehicles of all kinds, guns, dueling pistols, harnesses or a worn oxcart wheel, costumes of men, costumes of women, shoes, hats, children's dresses, everything can be found in his collection, and all were used in his paintings. Very often he was asked where he got them and people would hardly believe him when he said he owned them all.

I have his diaries from 1860 when he was sent alone to Paris to study art, because from babyhood he was an artist. When other children were given children's playthings, he would sit quiet and happy if he could only have paper and pencil trying to make some mark or little drawing that would look like something real. And when fame came to him he said he could still often feel the thrill of ecstasy that came over him, baby as he was, when something that looked like a figure was on the paper. He was only a very little child, but he had created something. A little older, when children ask for toys and playthings, he asked for brushes and paint. In church, to keep him quiet during the long sermons of that day, he was given a pencil and Bibles, hymn books and prayer book were filled with battles, boats, horses and wagons. And if the minister happened to be preaching about the warriors and heroes of old, they too were generally to be found among the drawings—[as like as not] David, a very fierce man, and not at all as the sweet singer of Israel, but as a boy fighting Goliath. When only five years old, he was watching with deep interest a string of boats on the Connecticut shore, and was seized with a desire to make a picture of them, so with pencil and bit of paper he did his baby best to make them look as he saw them, with recognizable result.

In that day when a boy left school, it was thought that he must be put in some business, mercantile or otherwise, and he was sent down as a messenger in Wall Street for a beginning. One day's trial was sufficient. He was given some bonds to deliver in a great hurry. Reaching the bank, he was attracted by an engraving of early American history hanging on the wall and stood so long looking at it that the president of the bank, noticing the young boy's interest [to be] so great, became interested in him, asking his name. The engraving which heretofore was merely a piece of furnishing for the bank wall, gained great interest through the boy's eyes, and time flew.

Suddenly awaking to the great need for hurry as it was nearly time for closing, he was charged to run all the way back. But again seeing pictures in a window in the street [he] forgot hurry, time, bonds, and returned to the office long after closing hours,

interest on bonds for that day lost. Then his family gave up all thought of a business career for the boy and allowed him to follow his own inclination and study the one profession he loved.

Student Years

Mr Henry was only 19 years old when he went to Paris to study art. He had been studying some time already in Philadelphia, as schools were considered more advanced there at that time than in New York, but showed such ability that his family was advised to send him abroad, where in the ateliers of various masters he would have greater advantages than at home. I think he studied with F. Weber, Courbet, also Gleyre, as well as copying in the Louvre. A large copy of Vibert which he made at that time is still in existence and brilliant with color.

Art at that time was almost purely classic, pupils being drilled in drawing before they were allowed to use color, first from casts, then the life class, which is still done, of course. But it was drawing, drawing, drawing, and I think that early drilling is shown in his paintings; for I am quite sure every one will concede that his drawing is quite perfect and hardly ever to be criticized. In later life when students often came to him for criticism on what they were doing, bringing their work with them, he would beg them to, before learning to paint in colors, learn to draw, then study perspective, composition etc.

Once, in passing a class of students who were sitting in the road trying to paint from nature, they asked him to help them or at least tell them why the road would go up hill on their canvases [in spite of] all they could do, when in nature it went down. In a few moments with the brush in his hand, it was all right. Then he gave them a lesson on drawing and the importance of even *drawing in color.* Color itself was easy enough if one only knew first how to draw and the rules of perspective. A foreign artist who was looking at one of his paintings said, "Henry is truly a master of drawing and perspective."

In looking through his diaries which commence from his student days, I find how much he had to study from models classically draped, but his eyes were always open to everyday passing events. Even in those early days of hard study, his great interest was centered in life around him; but the greatest interest was American history. In school days the lesson in history was always read so far beyond the given lesson that the teacher would be compelled

to stop him at recitation. The lesson was given for a certain chapter perhaps, but there was hardly need to study or memorize for him, for his memory was almost abnormal and he would read on and on until the book was finished. In other studies he might be quite defective, but never in history. He never forgot dates; ask him at any time when such or such an event happened, instead of mentioning a number of years he would tell the exact date of the event.

When the students in the class in Paris were told to bring in a sketch, the subject their own choosing, he brought in a little picture of the French *Voiture de Chemin*, people inside and out, the conductor standing on the steps behind, people passing in the street and the street stretching far off in the distance. It was condemned as very commonplace, uninteresting and not "art." It was what had appealed to him, however, although he had to continue drawing and painting from the classic.

Mr Henry was always very fond of traveling. Even in those early days of 1860, when only 19 years old, he took advantage of intervals of study to visit the noted places of Europe. Writing again from his diary of that date:

He sailed from New York Saturday, September 22d, (CAT. 17; FIG. 229) going directly to London, where he stayed until Oct. 29th, visiting all places of interest. Oct. 29th, he left London for Paris where he began his studies in art and copying in the Louvre, taking lessons in French, going to a gymnasium, taking lessons in fencing, in which he became very proficient. He went to Lyons, Marseilles, Napoli (Naples), (CAT. 18; FIG. 94) Genoa, Livorno, Civita Vecchia, Parsleppo, Pompeii, Vesuvius, Rome. Of course, in Rome he went to the ateliers of Rogers, Buchanan Reed. Saw the Pope at St Peters, blessing the people; went to the Coliseum, which he saw by moonlight and writes in his diary, "Grand magnificent picture." Up early next morning to go to Grotto Ferate, then Frascati, (CAT. 19) took donkey ride to Tusculum, again writes of visiting Crawford's studio and Buchanan Reed's making his studies and sketches everywhere. Leaving Rome, April 9th and stopping at Florence, (CAT. 20; FIG. 233), seeing the races, (CAT. 53) of which later he made a painting, and going to Power's studio. Leaving Florence April 21st [for] Genoa, Spezzia, Milan, stopping some time at all places of interest for sketches. Venice, Verona, Mantua, Reggio.

His diary is full of descriptions of places he visited all the way back from Paris. Up early many times at 5–6 a.m. and once at

3.30 to take an early diligence, from one place to another, missing no place on the way, walking up hill and down, [seeing] cathedrals, academy d'art, picture galleries, churches. Mr Henry was never very strong, and on many pages of the diaries, after these long walks and sightseeing is written *"Malade Tout le Nuit."* He seems never to have rested, but with indomitable energy is up the next morning early that he may miss nothing of what he is seeing and making sketches of the interesting scenes. The Messrs Valentines of Richmond, Va., the sculptor and brothers noted for their excavations in the south and southeast, and establishing the Valentine Museum in Richmond, figure largely in the diary at this time: "Going out with Valentine. Going to Valentine's room. Going to cafe with Valentine." I think he traveled extensively with them also.

[The entries continue.] Lake of Como, (CAT. 21, 22; FIG. 234) Lake Maggiore. (CAT. 23, 24). Taking a boat. Rowed on lake. Took sketch. Stuttgart, (CAT. 26; FIG. 236) where he describes the baths and beer gardens and has funny little sketches of them. Frankfort, Dresden, Berlin, (CAT. 27, 28; FIGS. 237, 238) where he stopped July 4th and writes of going to a big Fourth of July dinner at Arum's hotel. *"Beaucoup* Americans, speeches and tracts till 12 p.m." He took lessons in German, but was very ill, being confined to his room; however, using the time by "making sketches *out of the window."* Then comes Potsdam. Here he writes of receiving news of defeat at Manassas and account of Battle of Bull Run. Back in Berlin he continues his studies in German. He makes many excursions to neighboring places, going to concerts, museums, churches, picture galleries, "festas," walking and apparently never weary. Düsseldorf, Coblentz, Bingen, Baden-Baden, Heidelburg, Strasburg, Chalon, Paris.

On Monday, November 28th, he went with other students to call on Gen. Winfield Scott at Westminster Hotel. The Gen. so great as a Gen., so great in person, was sitting in a great chair under a draped flag of the stars and stripes, and gave the young men much good advice. January 19th he attended a reception at the U. S. Consul's, [U. S. Minister] where he seems to have been a constant visitor as well as a welcome one. A very amusing incident occurred while in one of the large cathedral cities.

Meeting an acquaintance one day in the street, both walked on to the beautiful building. Close by the street through which they were walking was a narrow rather dark street filled with small

shops. As they both stood looking at the towers (as he thought,) he said:

"What wonderful carving," Mr. H.

"Yes! most beautiful," friend.

"The coloring is exquisite."

"Wonderful; I have never seen finer."

"It must have taken man many years to do it."

"Y-e-s, but not necessarily so very long."

"Oh, yes it has! Time only could bring out such wonderful colors in the stone."

"S-to-n-e, there is no stone about it."

"Why! What do you mean? It's all stone, nothing else."

"What are you talking about? It is not made of stone at all my boy. They never make them of stone."

Turning to look at his friend with astonishment, [the young student] found *him* standing with his back to the cathedral, looking in a tobacconist's window at a beautifully carved meerschaum, while Mr Henry had been gazing at the marvelous carving in stone of the cathedral.

Back again in Paris with its great schools of art, the Luxembourg, its salon, the Eldorado for artists. Paris held so many attractions for him. So many friends were there. His diaries are full of accounts of gatherings in studies and cafés after the day's work had been accomplished, criticisms upon the salon pictures, and exhibition as a whole, merits and demerits of certain paintings; which school of art was the greatest, and which would bear the test of ages, visions of the great work each one was to do. These subjects are generally discussed.

Oh! how many names I find written in these diaries. Names so memorable and other names forgotten now—faded visions! All so happy, so young, heedless of much except the beauty of their own world, the world of art. What matter to them if sometimes finances were a little low and economy needed; a little self-denial did not amount to much. They had something so much greater in themselves, each in his own way living his own life, his life so full of dreams and beauty, their dreams of future greatness. Art had given them dreams, and they were trying to find a way to make those dreams come true. They were looking beyond a painted canvas and seeing the deeper meaning, the great difficulties overcome, the ideal attained.

He is back again in London, walking, walking everywhere, feeling miserably sick, for he was terribly troubled with dyspepsia,

but still making the most of time. He speaks of hearing Dickens in Dotheboys hall and the trial scene of Pickwick, and there is a drawing of Dickens. Here again he finds many friends, Boughton and others, then the Royal Academy, Derby races. He leaves London June 9, 1862, stopping at Chester and making sketches, Holyhead, Kingston. Then cars for Dublin, staying there several days, then Cork. Then Queenstown. Steamer for home.

He was never a good sailor, and each day on ship passes with but few entries, just some little note of some particular event of interest. One day, man overboard. Icebergs (CAT. 32; FIG. 241). Fogs—"tres froid." A little sketch of the end of the ship. On June 23d sees land and is home June 24th.

His diaries are full of sketches, sentences in French and in German. It was always much easier for him to illustrate a thought than to write, so the diaries are full of tiny sketches. When he went to the races in London, there is a drawing of the racing horses at the top of the page. When he heard Dickens, there is quite a good portrait of him. Fourth of July is drawn with flags flying and banners waving. Processions are all drawn out. Boats, R.R. going and coming, wagons of all kinds, each as it was used. Of course, everything is necessarily very tiny, as it must be in these small pages. But there is always character, open the book anywhere, and one knows in what place he was at that time by the little drawing found in it.

Young Artist in New York

Arriving in New York he took a studio in the Tenth Street Studio Building and he told me how the older men who were there resented such a boy coming there and putting his name on the door, but after a while how every one of them called on him, looking at his work and encouraging him in every way.

Mr John Taylor Johnson, remembered as one of the collectors of American art, gave him one of his first large orders, for one of the early R.R. paintings (he painted several besides the noted large one of the trial trip) and paid him $500, an almost unheard-of price at that time even by a man of reputation, not speaking of Church, Bierstadt, Gifford and a few others. It (CAT. 58) was placed on an easel at one of Mr Johnson's noted artist receptions, attracting a good deal of attention, as also the young artist. It was here he was introduced to Mr S. P. Avery, who at that time was dealing only in American paintings and who became one of his earliest patrons.

He kept his studio in the Tenth Street Studio Building for 25 years, and here he painted many of his important canvases, [including] a *Presentation by the Ladies of the Sanitary Commission, New York, to the First Colored Regiment in front of the Union League Club, Union Square, New York, March 1864,* (CAT. 82; FIG. 100) painted for and owned by that club still, [and] the historic painting of *Old Westover, James River,* (CAT. 51; FIG. 102) sketched from a U. S. transport on James river, October 1864, owned by the Century Club, New York. At the breaking out of the War of the Rebellion Mr Henry was very anxious to go but was too young to enlist as a soldier; so there was a position found for him [in 1864] as captain's clerk on a transport taking supplies down the James river to the army. He got all his notes and sketches for his painting *Grant's Headquarters at City Point* (CAT. 96; FIG. 107) at that time, although the painting was not finished until several years later. One day sitting on deck, he saw a short thick-set man dressed in uniform standing on the shore, watching him. He saw on his shoulders a band with four stars and instantly knew that it was "Grant." Then came to him the thought of the painting. The whole scene was there and his notebook is full of the sketches he made.

Not thinking of war conditions, he started out (as was his custom) to make his drawings. Climbing up the bank he was busy at work making his studies in his sketchbook when suddenly he heard shouting and felt stones falling all around but fortunately none hitting him. A guard was running and calling out to him in no choice language, "What are you doing? What do you mean taking drawings of this place? If I had my gun, there wouldn't be much left of you, I can tell you." Realizing only then his great danger, he said he never ran so fast in all his life, almost tumbling down the bank, and was glad enough to get back on the boat completely out of breath, heart beating almost to suffocation, almost dead with fright. I leave to the imagination what the captain said when hearing of it. As the boat was anchored near the shore, he made his drawings on deck afterwards and at a safe distance.

The painting was exhibited at a dinner given by the Union League Club of Philadelphia to Gen. Grant, who stood so long looking at it that, dinner being ready, he had to be literally pulled away from it. When Gen. Grant was President, Mr Henry was invited to spend an evening at the White House by Mrs Ann S. Stephens, the authoress. On the anniversary of her birthday, she

had received from the President a large basket of flowers and this evening went to the White House to personally thank him.

The President, understanding [that] Mr Henry was an artist, spoke of this painting, praising it highly. But when Mr Henry told him *he* had painted it, he seemed so young that Grant could hardly believe him until Mrs Stephens said: "Yes, he did truly. I took many a lunch with him when he was at work upon it, and also watched him, sitting beside him at his easel, while he was working, seeing him painting."

He told him how he had climbed the bank, the guard threatening him. The President said, "Why Mr Henry, why did you not send directly to me, telling me what you wanted to do? I would have given you permission to go any and every where, and you could have made all the drawings you wanted." Then he said, "We are the men who make history, but you are the men who perpetuate it."

This painting is so accurate in every detail that Grant could pick out every tent and even the seat he sat on before his own quarters. The painting is owned by the Union League Club of New York City. [It was sold in 1939. See catalog entry.]

When I first met Mr Henry, it was in the old Tenth Street Studio Building [CAT. 132]. It was a reception day, and all the studios were open to the public, but of course invitation was by card. It seemed to me that all of the noted artists of that day were in that building, Mr Church, Mr T. W. Wood, Mr Gifford, Mr William Beard, Mr J. G. Brown, Mr Hubbard, Mr Whittredge, Mr Bierstadt, Mr Casilear, Mr McEntee, and many others, whom it was an honor to know, and oh! what memories these names all call up. They have all passed into the great beyond now; but surely they have left work behind which speaks of a life well spent.

Mr Henry was painting interiors at that time also [1872 ?] but had just finished *Grant's Headquarters on the James River* now owned by the Union League Club of New York) [subsequently sold—E.McC.] which was being exhibited at Schenedecars Galleries, Broadway below Tenth. At this reception, there was the painting of the old clock on the stairs on his easel. The grandfather's clock, the pleasant room in the background with the sun shining on the old lady reading, the kitten playing with the forgotten ball of wool, are faithful portraits of an actual scene in an old house in Philadelphia. The painting (CAT. 70) is owned by Mr Robert Gordon, formerly of New York, but who is living now in Scotland. It was taken there with other American paintings he owned.

It may be interesting to know that Mr Henry sent a photograph of his painting to Longfellow by a friend; and I only wish I had the letter Longfellow wrote back, asking how it came to be painted, as it was exactly his own idea of the poem, especially of the clock standing on the stairs.

Somewhere back from the village street
Stands the old fashioned country seat,
Across its antique portico
Tall poplar trees their shadows throw:
And from its station in the hall
An ancient timepiece says to all
"Forever—Never!
Never—Forever!"

Mr Webster claimed the letter for taking [the photograph to Longfellow] although Mr Henry realized its value, but with his usual kindness let him have it. He was lost on a steamer going to California, all his effects with him, and this letter with them also.

[An unidentified newspaper clipping pasted in the manuscript here completes the story.]

On Monday (says a London letter) last died Una Hawthorne, the eldest daughter of the late Nathaniel Hawthorne. She was affianced to the late Mr Alfred Webster, and from the time of his death steadily sank and faded out of life—an end sad enough for any one who, with the writer of this, remembers the charm of her childhood and girlhood. It was beside this daughter that Hawthorne watched at Rome so anxiously and long during an illness, from the effects of which neither Una nor her father ever recovered. She was endeared to many friends in England by her many lovely qualities, as well as by her sorrows.

Travels in the South

He always said his work needed a wider scope than just the daily surroundings of his home, and felt that seeing other scenes and peoples which traveling could give him would broaden out his work and give him a larger prospective. He always said "art" should be spread over a large "aria." Consequently the many subjects covering so many different phases [to be found in his work.] South [for example, *The Temperance Preacher,* (CAT. 212)] as well as north yielded subjects for his brush.

Having a very pressing invitation to visit a friend living at Knoxville, Tenn., he thought it would be a good opportunity to see other places as well and find some new and different subjects. Mr George I. Seney of Brooklyn, calling at the studio and hearing of the proposed trip south, asked him to go to Atlanta, Georgia, and make a portrait picture of an old colored woman, "Aunt Dot," for him. She had been a slave in a noted family there; but when

she was given her freedom after the war, would never leave them although they had been very much reduced in circumstances as many of the wealthy families were. Mr Seney, knowing the family, was deeply interested in her, knowing of her faithfulness, hence the portrait. It gave Mr Henry an excuse to extend his trip for which he was very glad, so we went to Atlanta and the portrait was painted with some rather funny experiences.

"Aunt Dot" lived some way out of Atlanta, about a mile, but not hard to get there if plenty time was allowed for the trip. The little one-horse car would often get off the track and then we would all get out and stand waiting while all the men would lift it on the rail, but sometime the women not feeling they wanted the trouble of getting out sat still, so they were lifted with the car! "Joe," the driver, had taken many errands to do from any one meeting us, such as leaving some vegetables at one house on the way, eggs at another, a large tin wash-boiler at another and so on, the people waiting inside for each delivery, telling stories, the news and gossip of the day. We, of course, as strangers were kindly included, asked our names, and introduced to other and oh! how many *Colonels* there were.

One day Mr Henry forgot his painting materials, so I went back for them. As we neared the hotel where we were stopping, I asked "Joe" if he would, or could rather, wait until I ran up to the room to get the things, it might possibly take a few moments. But nothing loath, he seemed very willing and glad for a rest. Neither were the people in any hurry and waited patiently. One evening we were invited out to tea. About 9 o'clock our hostess asked us if we wanted to ride back, as "Joe" said if so, he would keep the car waiting our pleasure—as this would be the last trip for the day.

A picket broken from the fence could lay where it fell, one waited for another to put it back in place. Men sat on the piazza all day, chairs tipped back, feet on rail, no one hurried, every one took life so easy. Of course Mr Henry saw a picture in the dilapidated car, the equally dilapidated driver "Joe," the disconsolate little old horse; but he saw something deeper, touching in the sadness of it all, for indeed sad it was. The old horse had been a frisky young colt once. The car once had been new and bright with fresh paint, and "Joe"—well, "Joe" was still young in years. [He] would go on and on, year after year, driving the same old horse before the same old car, until by and by "Joe" would be an old man, horse and car long since gone, life over. Isn't there

something more than just a painted canvas, or method of work to see in such a picture?

Mr Henry always saw so much in such a subject, and I think it was just that "inner vision" that appealed so greatly to people—everyday commonplace scenes, in which so many see reproduced scenes and events that have taken place in their own lives. He had great power in creating a very human type, the portrayal of character even in an old cartwheel. The critics have not in many cases undervalued this capacity which made him so dear to the people.

Life in New York

It was one of his greatest pleasures to meet people, especially people of distinction. How vividly I recall those delightful evenings at Chief Justice C. P. Daly's, with that dear old man and his charming wife Maria (CAT. 197; FIG. 58) and also the many weeks spent in their summer home, Sag Harbor. They always gathered around their fireside so many interesting people, and the judge's stories and anecdotes of old New York and the people of that time, the intimates of his younger days, were listened to with such interest and pleasure by all.

Paul Du Chaillu was always a most welcome guest, and his personal stories of his African travels lost none of their interest in his telling; for he was a great *raconteur,* and we were told many incidents not found in his books. Some days we all went out in the judge's sailboat, some days only the judge, Toby his faithful dog and ourselves. [See Sketchbook 18 (CAT. 1202).]

Mr Henry made many warm friends, and a friendship once made was rarely ever broken unless by death. [Among these were] Charles Peterson, the publisher of Philadelphia, [and] Mr Chew of Cliveden, the historic "Chew House" at Germantown, where the battle of Germantown was fought, and where two of Mr Henry's paintings. *The Battle of Germantown* (CAT. 144) and *Reception Given to Lafayette* (CAT. 114) (given in that house) painted for Mr Chew, are now hanging. Mr William Astor, seeing this painting in Philadelphia, gave Mr Henry an order for a copy of it, which was made, (CAT. 161) [he] making some changes so that it would not be a faithful copy.

Mr Henry rarely forgot a face even if seen only in print, although a name would often escape his memory. One day when going to the bank in Paris, there was a large fine-looking man coming out; he was buttoning his glove. Mr Henry had a habit of speaking his

thoughts aloud and instantly said: *"C'est Rossini."* The man, of course, looked up and seeing the young boy regarding him so earnestly said with a smile, *"Oui, mon garçon. Je suis Rossini."* When a student in Philadelphia, taking his usual afternoon walk, he saw a quaint looking little old man dressed in the costume of the early [19th century] knee britches with large silver buckles at the side, a long coat, hair tied in a queue, gold-headed cane. "Sully, the artist," he said. A glow came all over him, for he had seen Sully. Could it ever be possible for him to attain such greatness as that little old man?

He was greatly interested in keeping the old landmarks of the city for coming generations. With Mr Kulp, a noted antiquarian of Philadelphia, he made the restoration of Independence Hall as it is today. In scraping a little of the paint off, he saw [that] the original red and black bricks had been painted over and over. With a great deal of opposition from the city fathers, who said they did not need a young "upstart" from New York coming over there telling them what should be done to one of their own buildings, [he] finally prevailed and the paint was scraped off and the old brick brought from Europe was laid bare. Every one then acknowledged the improvement, and it is still the same now, as it was originally, showing the old red and black brick.

The painting (CAT. 79; FIG. 112) of St John's Church in Varick street is now historical. While at work upon this painting, he went down there over and over again as was his custom, to get the absolutely correct drawings; for fortunately the church was still standing and one of the finest, if not the finest, examples of Sir Christopher Wren in America. Varick street, when it was built, was about the "court end" of the city. The park was beautiful, full of large trees, walks, seats, the houses around it occupied by the noted old families who lived there. Sometime before the park was destroyed to give place to the ugly warehouse now occupying its site, Mr Henry had had photographs taken of it, [as also he had had photographs taken of the New York Hospital on lower Broadway and other public buildings, which are still in his collection, and which have given place long since to many skyscrapers and business houses.] So with the aid of them and stories of how it was filled Sunday mornings with people going and coming from church, he has made two very accurate paintings of the church, the park and Varick street in the days of their early greatness.

He made every effort by writing to press and everyone he could meet to take a personal interest in keeping this beautiful example

of early New York for New York and the beautiful architecture intact, but to no avail. It was necessary to widen the street. He wrote to Mr McAdoo and others who he thought had influence. He suggested that the street should go under the park as he had seen done in London, and I think it was done for a short time. But the church was sold, and another of N. Y.'s old splendid landmarks has been destroyed. I think there was some suggestion that it should be taken down and rebuilt further uptown; but I am not sure anything was ever done about it.

To be sure, that part of the city is peopled with Italians or at least it was when we last saw it. But even so, what a great pity such beautiful architecture which should be the pride of a city must be destroyed to give place to money-making ugly buildings.

In looking at the paintings, how much they show of the great changes which have taken place in New York. What a difference between the present, with the noisy autos making a walk in the city not only a brain-racking thing, but a menace to life as well, and the quiet Sunday morning of that day.

Travels Abroad

We were invited when last visiting Europe to spend some time in the home of a most interesting French family at Rheims, France. I do not know that that is a pleasure given to many travelers; but certainly to us it was one of the events of our life. We are so constantly reminded of the trivial life of the French people and generally think of them as leading just a life of gaiety and frivolity.

There is no word in the French language which expresses our English word "home." But we *were* entertained in a French "home!" And although I have been in English homes [and] American homes, I have never seen anything more beautiful than this "home" life of that French family. The great honor paid to father and mother, the kindly consideration shown to brother and sister, the loving care of parents for children, and the most charming hospitality to the guest.

In the early morning until breakfast *a la fourchette,* neither host nor guest were expected to interfere in any way with each other; but each followed the duties of the day in their own way. Meeting each other in the early forenoon, there was a bow and pleasant "good morning" only. The guest was left to read, write etc.; the hostess attended to her duties of the day.

In my case it was somewhat changed; for with a most thoughtful kindness, as I was a stranger and young, with a very imperfect

understanding of French, the eldest son and his wife came to stay at the father's house, so I would have a companion of my own age. She spoke English as little as I spoke French, and those many morning hours what jolly times we had, she with her English dictionary, I with my French. What funny mistakes we made, and how we would laugh, and I think she enjoyed it, as I am very sure I did.

The afternoon was given up to drives in the surrounding country, and the evening to entertainments, neighbors coming in to call on the American artist and his wife, for in France an artist is held in decided high esteem. One day a *fête champêtre* was given in our honor. Early in the morning, servants with tables, comfortable chairs and hampers laden with the delicious breads, cakes, patties the French cook makes so temptingly were sent ahead to prepare for our later coming. Then [came] the ride through that interesting country, the long day in the woods, the tables beside a clear, sparkling stream, the plentiful wild flowers which as I picked them (the daisies and buttercups of my homeland) brought a twinge of homesickness. Then the coming back in the gloaming, stopping for a large and fashionable dinner at the *Juge de la Pays*.

This whole country was all so highly cultivated at that time because it was the noted champagne country of France. [Here were] the estates of the Count of Montebello, of Mon. Heidsick (Piper-Heidsick) and the wonderful place where we were visiting, Mr Bouchait, where the great wine vaults were so large that the sons themselves had to take a guide to go through them.

Day after day [it was] one constant effort for our pleasure and entertainment. Is it any wonder that in looking back upon that visit I know there is a beauty in the family of France excelled in no other country?

If I should go back there today, I would see it all changed. War has passed over it. Those great vineyards are all torn up. Old Rheims Cathedral, so rich in history, [is] a ruin. And the dead friends who made our visit one never to be forgotten [are] all scattered. I shall never go back again. The dear companion who made this visit possible for me has gone, too, and I am all alone now with only memories left.

Coming home, we stopped in Paris. Mr Ridgeway Knight, [CORR. Nov. 8 '75] a lifelong friend of Mr Henry, was living with his family in Poissy, and wanting to renew a student friendship, we went to see them. Meissonier's studio and home was adjoining Mr Knight's, a gate separating the one place from the other. And although Meissonier was not at home then, his son Charles was,

and Mr Knight, who was an intimate friend, took Mr Henry there to call.

I wonder if the lay public can ever realize what pleasure it is for one artist to meet another who paints in the same school of art as himself; the comradeship, the pleasure of talking over methods of work, mediums used, colors, oils? It was so in this case. A few panels of Meissonier, given to him [E. L. H.] at that time, had a value no money could buy. Mr Henry had made a little study of Mr Knight's boy (the present artist), which was shown to Meissonier, who praised it highly, saying he regretted very much not being home to meet the American artist, who was very often called the "Meissonier of America."

Meissonier always stood to Mr Henry as the greatest artist of his time. And the pleasure of going to his studio, seeing his studies and sketches and through them his methods [was very great.]

The Passion Play

I have said he was a painter of American subjects which indeed he was. But I should say *almost* everything he painted was Americana; for among his paintings is found his picture of *The Passion Play at Oberammergau*, 1860, (CAT. 99) where he passed two or three months. [He painted also] some subjects in Warwick, England, where we spent two summers, a few in London, also a few in France. (CAT. 123–29.)

It was very interesting to hear him tell of those weeks spent at Oberammergau. [In his painting of Oberammergau, Mr Henry is seen sitting in a back seat sketching in his sketchbook. E.McC.] He was allowed to make drawings of the interior of the open air theater and small sketches in his notebook sitting at the extreme back of the building. But I think he was the only one given that privilege, as at that time the reason for this play was purely its great religious significance, and as such was to impress the people, that anything drawing away one's thoughts from the seriousness of it was not allowed. Dean Stanley was there with Lady Stanley and became greatly interested in the young artist, asking him to visit him in London and giving him a card to Westminster Abbey and St Paul's, as a special privilege to go there to make drawings if he so desired. He met many other travelers of interest, drawn to the place as he was by this wonderful play of the life of our Saviour. But the one who left the more lasting memory even than that of the play, was the old white-headed priest about who [*sic*] the

children gathered in loving embrace, as he walked in the paths, with his hand always raised in blessing, not only for them, but every one whom he met and upon whom his kind benevolent glance fell.

Mr Henry formed a great friendship with him and was often, as he said, one of those upon whom that blessing was bestowed; and he carried away with him the remembrance of the picture of that kind old man, the little children crowding about him, his hand on their heads, and the sun and shadow making a beautiful picture of old age and youth. When he came back to America, he sent him some book and other things representative of America; for he had through long years of study spent amidst those great mountains and in the quiet of his cloistered life attained a knowledge of the outer world and languages, thus could read and speak English and knew a good deal of America.

Life in Cragsmoor

In his walks how much he saw that escaped the notice of others. His great love for dogs, birds, flowers, early spring with its tender soft color, the blossoming plants, late fall with its glowing golden sunshine and falling leaves, [may be seen in many paintings.] Very often when he was painting out of doors, the birds would come on the branches of the tree under which he was sitting and answer his whistle, never seeming to fear, and once one perched on his palette in the vermillion paint, waiting there a moment and then leaving the prints of its little feet on everything as it flew away. Perhaps his two little black-and-tan dogs, Peter and Charlie, his faithful companions who figured so often in his earlier paintings, may still be remembered, as also the great St Bernard, Don.

He felt for all animals a close human companionship that seemed to draw them to him. And how he would stand entranced over our wonderful mountain sunset, a faraway look in his eyes as if he could see far, far into the beauty beyond. This little poem found in his diary will tell better than I can what his thoughts were then.

Do you ever think when the skies are blue
And the clouds in the west are an amber hue
And a shaded red and a shimmering white
That the Great-All-Father takes delight
In seeing his children rest awhile?
Has the day been weary and the task been long?
Lay care aside, and let a song

Rise to your lips as you gaze at the sky,
For the glories of Heaven seem passing by
And the Great-All-Father shifts the scenes.
For some life seems but an idle play,
While others are burdened with care alway,
But idle seeming oft hides the pain
As the sun oft shines in the summer's rain;
Yet the Great-All-Father sees it all.
And the beauty of sun and cloud and sky,
That gilds the west as night draws nigh,
But shows the love that will safely hold
Each trusting heart of this trusting fold
Till the Great-All-Father leads us home.

And when at last the "beauty of sun and cloud and sky" had faded slowly away, leaving only the wonderful afterglow, and that, too, giving place to still evening shadows, with that faraway look in his eyes almost as if he had seen beyond the cloud and sky, asking not to be spoken to, he would go in his studio, and make a little memoranda with his pencil, drawing in the shape and color of the clouds. And after one of these beautiful sunsets, he would be so very quiet, hardly speaking again all the evening, but in the early morning with the help of the sketch [he would] make a study in oil of what he had seen the night before.

Everyone who knew Mr Henry spoke of his unique and charming personality. [He had] the gentleness of a child yet the strength of a man, [coupled with] extreme modesty and a passionate love of nature, seeing beauty in everything, standing absolutely alone in his method of work. [One critic wrote that he was] "always true to his own ideals; for when fashion and art changed from the carefully thought-out detail and close imitation of nature to that of the impressionist, he never changed his own way of painting, he painted as he saw everything." He always worked directly from nature. Often out in a field with a board fastened to his palette, he would follow a horse around or, sitting at an easel in the field, watch them as they moved, studying the play of each muscle.

One day sitting thus absorbed in his painting, he felt a breath on his head, looking up, [he saw a] horse looking over his shoulder evidently wanting to see what it was all about. Perhaps feeling satisfied with the result, [the horse] trotted off, and Mr Henry went on with his work. (CAT. 1032–50)

Nothing seemed to escape his eyes. He rarely painted a picture but there was sunlight in it, for his own life was so full of sunlight.

But as in every life there are shadows, so had some of his pictures. And when, in an exception, the canvas showed a dark cloud, there was always a pathos that touched the heart.

A good many of his subjects were found in Ellenville and the surrounding country, as also in his home at Cragsmoor. I am sure he had a warm place in the hearts of these people; for they always showed a pride in him and his work and, whenever he asked anything of them, always willingly allowed him to go wherever he wanted to. In offices or homes he was always welcome.

In his *Lawyer's Office,* (CAT. 264; FIG. 150) a lawyer kindly put his office at his disposal (McCausland, June–Aug. '41, p 137). *Before the Days of Rapid Transit,* (CAT. 907) a water color well known by its many reproductions, was painted from the Delaware and Hudson canal which ran through the village. And although the scene of the painting is laid back in the early days of the state waterways, he could sit with [his] easel in a window jutting over the canal and paint the hills and valleys from nature, the same as when canal and canal boats were the means of quiet restful travel.

The shrill whistle of the train comes to me as I am writing. "Rapid transit," the hurry and rush of today, has taken the place of the slow gliding boat, gliding so quietly and peacefully through these lovely mountains and valleys. The old canal boat is gone, the canal bed is covered with grass and weeds, restfulness has given place to restlessness, but the everlasting hills, the peaceful valleys, are the same as when God's hand formed them in the long, long ago.

Again quoting from an article taken from a magazine:

> *Much of Mr Henry's work is the portrayal of the homely everyday life of the village and farmers both in New York State and in the south. There is often much insight into character and portrayal in these paintings of country life. The lawyer and his client in the* Country Lawyer *are lifelike studies of country character. The old, brown, gray or white country nags that amble through Mr Henry's out-of-doors canvases deserve a word to themselves so true to life they are.*

Important Paintings

In answering the question, "Which of his paintings [did] Mr Henry consider the most important?", I should think first of all would be *The First Railroad Train in New York State,* which now hangs in the Albany Institute of History and Art, (CAT. 257; FIG. 162) presented by Mrs Abraham Lansing of that city. It is the largest and has the most figures in it of any he ever painted.

Sunday Morning (The Old Church at Bruynswick), (CAT. 283; FIG. 67) *A Virginia Wedding* (CAT. 231; FIG. 155), *Country Wedding* (CAT. A-912), *Colonial Wedding* (CAT. A-910), *The Election of 1842* (CAT. 373; FIG. 25), are among the most important as to size and detail. *Before the Days of Rapid Transit* (CAT. 907), a water color, is well known by the many reproductions of it. There are so many, however, I could hardly name them all.

One of the last ones he painted is *St Marks in the Bowery* (CAT. 381; FIG. 215). He was as fond of the many small ones and took as much pains in painting them as to details as the larger ones (CAT. 1213). The people in all his paintings were real people to him, and he always seemed to feel as if they were really living.

His painting of *The First Railroad in New York State*, was maturing in his mind fully ten years before he commenced drawing it on canvas. He had studied every work that could possibly help him, bought books, wagons, costumes and had even drawn it all in on the canvas as he thought it should be, but somehow was not satisfied as to the location from where it started.

He went to Albany to see if he was right, and through the kindness of Mr Abraham Lansing was introduced to some of the men who were there at the time and who not only took him to the place from where it really started but told him of many incidents which happened—how great crowds of people came from all over the country in oxcarts or any and every kind of conveyance to be had, how people had to hold umbrellas over them to keep the sparks from the engine from falling on them, and the umbrellas being burned.

The wagons behind the cars (which were stages put on trucks) waiting for the start so they could race with it; many bets being made of which would get to Schenectady, the end of the journey, first; wives bidding husbands goodby with tears, fearing the awful perils of this dangerous journey; the conductor running by the side of the car; the barrels of wood to feed the engine—all are shown in the picture.

He painted most of this painting at Cragsmoor; for he had an opportunity of getting men to pose for him and would have as many as three or four at once to get the natural action he wanted. And as he had his own wagons he could pose his models as he wanted them, stretches of fields are here, and down in the village of Ellenville is the railroad. And although he had been in Albany

to get the exact place from where the train started after making his drawings there, he elaborated them here from nature.

It is a singular thing to know that in painting so many of the historical subjects how many facts known to only a few came to him. He was one evening describing this picture to a very old man and, as was his custom, illustrating it on a bit of paper, when the old man said, "Why, Mr Henry, I was a young man then and was on that trial trip, sitting in the front stage, and heard an argument between the others that steam could never be used for any practical purpose. Feeling I was too young to take a part in the discussion I was a silent listener. But that evening [I] wrote my article to the New York paper (I think it was the Evening Post) saying before the end of this century we would take our breakfast in Albany, our dinner in Syracuse and supper in Buffalo.

"The editor had a note at the bottom of the article, 'That it was very good and well written [and that] the writer was very young and greatly ahead of his time, [that] perhaps at the end of the twentieth century steam would be used as this young man predicted, but it was hardly possible." Remember, this trip was 1832.

This photograph [FIG. 162] is too small to show all the detail; but if one could know all the painstaking labor to be historically correct and how he worked on it. It was to be finished in time for the Chicago Exposition. But it was not, as he was taken very ill from close application and exhaustion. It was accepted, however, as it was still unfinished. He went to the exhibition hardly well enough and much against his doctor's advice, but was greatly pleased to see it splendidly hung and a medal upon it. He stood modestly back of a great crowd before it, hearing criticism upon himself as the artist and upon the painting, which I am glad to say were not at all adverse.

Names of the passengers shown in the picture, on the Mohawk and Hudson Railway train, 1832, [are], from left to right:

1 Unknown
2 Lewis Benedict
3 Jas. Alexander, Prest., Commercial Bank
4 Chas. E. Dudley, Dudley Observatory
5 Jacob Hayes, high constable of New York
6 Major Meggs, sheriff
7 Unknown
8 Billy Winnes, penny postman

9 Unknown
10 Unknown
11 Thurlow Weed
12 Unknown
13 Ex-Gov. Jos. C. Yates
14 Unknown
15 Unknown
16 John Hampson, engineer.

It was exhibited for some weeks in the Metropolitan Museum, as well as in the Rotunda of the Capitol at Washington, and there was a good deal of pressure brought to bear to have the Metropolitan Museum purchase it.

Through Orange and Ulster counties, . . . there are still standing many of the old stone houses built during the time when it was necessary to build so much for protection against attacks of the Indians who were roaming all over this part of the State. Everything that had any history or story greatly appealed to Mr Henry. Friends living in the vicinity of many of these stone houses had not only told him about them, but had described an old church at Bruynswick, Ulster county . . .

When we went to see it, it was one of those quiet, warm, midsummer afternoons when all nature seems to be asleep and at rest. Only the song of birds was in the air. Our ride led us through a farming country noted for its beauty of landscape and rich pasturage. In the fields around the cows chewing their cuds were lying under the shadow of large trees. A soft purple haze was over the mountains in the distance, and over all a few soft white fleecy clouds in the deep blue sky.

When this beautiful old stone church—standing so stately alone in a broad stretch of green grass, its four [five in reality—E. McC.] large round pillars supporting the roof of the porch, the gallery staircase built under it and leading to the upper story, the weeping willows on the one side, the tall shade trees shading the old graveyard with the antique gravestones with the quaint inscriptions of long ago at the side and back—came in view, it was indeed a very lovely scene [McCausland, June–Aug. '41, p. 29–31]. As Mr Henry stood looking at it, he said it seemed suddenly as if the present time passed away and a curtain rolled back, and he saw it again as it was many, many years ago. He saw a clear bright beautiful Sunday at the close of service; people dressed in the costumes of that time, yellow, green, red, blue, pink and white of the

women and only slightly less sober tints in the coats and breeches of the men, walking away or standing about in groups chatting with each other; wagons, gigs, carriages in waiting, each and every type was all carefully seen, and an air of perfect naturalness to it all. He said it was all as vivid as if he was there.

The pastor, a white-haired old man, seemed happy to see us and welcome us. He had preached there a good many years, he had baptized the little ones, married the older ones and blessed for the last time many of those who were lying so quietly sleeping in the old church yard. He loved the old church and told us so much of its history.

It was built in 1700 [?] during the fearsome sudden attacks of Indians, and during services had always to be protected by a guard walking around it outside. As the men of the congregation came in, each one would stack his gun in the middle aisle, letting the "wimmen folks" go in the seat first and themselves taking the end to be ready to snatch their guns at a first alarm of the "Indians are coming," which was very frequent at that time. Some changes had been made during the many years. Many more new-made graves [are to be seen] in the old churchyard, some trees had fallen with age; but the old church is still just about now as it was then.

Mr Henry slept that night with picture in his dreams. So it was an easy thing to go back the next day with easel, brushes and paints, and make all the sketches from the actual scene and after put the figures in from life as he had seen them in his vision. Friends and relatives all furnished models for each character, his own collection furnishing dresses of both men and women and the vehicles too of that time.

Many people motor to see the old church today and, walking in the aisles where the guns were once stacked, see the reproduction of his painting hanging on the wall. Perhaps the curtain may roll back for them as it did for him, and they may see it all again through his eyes and his work. The reproduction is illustrated on the opposite page, [this refers to Mrs Henry's manuscript; here see Figure 67—E.McC.], the original painting was bought by Mr. Myers of Albany, and I think his daughter still owns it.

One Sunday morning just as we were starting for church, he suddenly said "Please go on, I will join you in a moment." There was a "faraway" look in his eyes, as if things present were forgotten. So I left him and went to church. Service ended, and he had not come. I hurried home wondering what had happened. I found him perfectly absorbed in a drawing. As I entered, he

looked up in surprise, saying "What is the matter? I am coming right away. Don't wait." I told him church was all over. "Why," he said, "you only just went out." The hours had passed for him only as moments, and he had drawn in his noted painting, *A Virginia Wedding,* (CAT. 231; FIG. 155).

Of course, this painting is purely imaginary. The building is drawn from the beautiful southern mansions of the large estates or plantations of Virginia. In his own collection he had the costumes both of men and women of that date, also the stately coach of the same period. The bride, bidding her mother goodby, wears a dress of white gauze with a satin leaf woven into it. It was worn over white satin [made with] plain waist and large puffed sleeves. The small close hat, slippers of white satin, etc. [are of the period.] The groom, bidding the father goodby, has over his arm a silk shawl of brilliant colors brought from China by one of my own ancestors.

As a general thing Mr Henry used only the regular professional model for detail in costumes and poses, but found the character he would need in people around him. In his own quaint way, he would ask any one he saw who happened to represent just the person he wanted in the picture he was at work upon if they would not let him make a little drawing of them [as] he would like to put them in the painting. They might be very much astonished and often were, but I cannot remember that he was ever refused.

In this painting Dr Howard Crosby, our pastor and very dear friend coming to call one day, was chosen as the clergyman and is seen standing in the door. It was such a good likeness of him that at the time of his daughter Agnes' wedding, the picture was etched on white satin and presented to her as a wedding present.

Colonial Wedding (CAT. A-910) is also a large painting full of figures. Of course, the scene is in a measure purely imaginary as it represents a time before the Revolution. The date on the old stone house is 1600 [?] and it is one of the stone houses built in the early Indian times. My grandmother, who lived to 96 years old, with her sister owned the historic Sir William Johnson Hall, Johnstown, Fulton county, N. Y., now owned as a museum by the State.

One day when Mr Henry was sitting with her she told him about her marriage, which was a large and grand affair. The farm hands were all invited [and] a table was spread for them on the grounds adjoining the mansion. Friends from far and near came

to celebrate the wedding, a separate table for the friends and family being set at the front of the hall. In that early time there were few carriages in the country, and the wedding journey, only one mile to the village, was taken on a pillion behind grandfather's back, she holding on with her arms around his waist. A little horsehair trunk was strapped on the pack horse to follow.

It was only necessary to tell Mr Henry some story of those early days to get his interest so greatly aroused for a painting to be made, and *Colonial Wedding* was the result of her description of her own wedding. Although it in no way represents the hall at Johnstown where my grandmother's wedding took place (for he laid the whole scene in Virginia) the idea came from her story originally.

The scene is laid in Virginia as being more possible for him to depict a fashionable wedding of the early colonies there. The English officers from the boats lying far off shore [and] the peculiar costumes of the women were all carefully studied. He was criticized as to the boats [his critics] saying [that] boats of that kind were Italian catamorans and such boats had never been seen in America, but he proved by history he was correct.

The bride is here seen riding on a pillion behind the groom; and what a time he had to find some sketch of one! Schoolbooks, libraries, histories were all searched in vain. No early drawings or pictures that he could find gave him any clue as to what a pillion looked like, until about this time being in Washington, D. C., and going through the National Museum, he saw carefully preserved in a glass case by itself a worn old ragged pillion. Introducing himself and saying for what he wanted it, it was taken out of the case, hung on two chairs, and he was allowed to make his studies of it.

The pewter dishes (all pewter dishes were used then) were from a set owned by a friend who had an entire dinner set and kindly loaned them to him. A table was set out of doors with them on it. [The friend was Miss Belle Dellenbaugh.] It was not difficult to get the rest of the needed material, [such as] Indians, Indian women with papooses strapped on [the] back, dogs gnawing bones thrown to them from the table. The English officers, the dresses of ladies of wealth and fashion, are historic. Our own surrounding country supplied the old stone house, and imagination the rest.

Another of his large and important paintings painted more recently is the *Election of 1842* (CAT. 373; FIG. 251) when Polk and Henry Clay were the contestants. One evening calling on a

friend, Mr Henry was shown an old scrapbook, made especially for her at that time. It was full of cartoons and the crude engravings of that day of habits and customs now obsolete, such as colored men going through the street with a long pole borne upon their shoulders, upon which was hung perhaps two or three dozen of the high boots men wore at that time, being taken away to be blackened. [Shown, too, was] the little colored chimney sweep who was sent up the chimney to keep it clean on the inside from the accumulation of soot and perhaps swallows' nests, with him his employer carrying the long stick to which was tied the brooms and brushes used for that purpose. There were also songs of that day, [and] there were the posters with names of contestants for offices, for pasting on signboards.

Mr Henry was greatly interested in this book; for he had for a long time thought of painting an election of about that period, and here in this old scrapbook he saw so many things he needed for the painting but never had been able to get such detail as was here shown. I think perhaps his first idea of such a painting came from seeing an election in Ellenville about 1888, which struck him as being very picturesque.

The village street full of wagons, oxcarts, all kinds of vehicles, then especially the old man being carried in a chair to the polls, [all are] seen in the painting. This man was 90 years old, too feeble to walk but still mentally strong. So fearing to lose a vote, friends carried him in that way so he could cast his vote.

Of course, no women were ever seen in the streets which were crowded with men, but were often onlookers from upper piazzas at the taverns or [from] behind jealously closed blinds; perhaps not so tightly closed, however, that one could not look down to see what was going on, or look up to see some pretty face peeping through them. Oxcarts, wagons, men arguing with others who were doubtful as to their vote and thus could be influenced for the wished for man [furnish detail.]

This painting was exhibited at the World's Fair in California, won its medal, and [was] bought by a gentleman in Massachusetts, I think, who wrote Mr Henry a most charming letter in appreciation of it. A very gratifying thing for an artist to receive, especially when he has worked hard and long and himself feels that he has made a success of his subjects. It is not always selling a painting that is compensation to the artist, but sometimes the kindly word of praise gives such encouragement, that even the paintings still to come show the influence.

I should mention another painting he was very fond of and felt he had great success in painting, *The Landing of the Clermont at Cornwall-on-the-Hudson* (CAT. 323; FIG. 242). He had painted most of this on his canvas, when as usual he wanted to get the detail more perfect. So in passing through Cornwall on his way to New York, he got out of the train and, in making the extra notes as he thought it should be, stood drawing in his sketchbook. An old man walking by stopped to see what he was doing. Mr Henry explained to him.

"But," he said, "mister, you are wrong. My father always came from his farm beyond here with his load of vegetables to send to the city by the boat, I, a little boy with him. The boat landed just below here." He then told him many more details, and his picture had to be all repainted. This tells of his great care to get all details perfect. The painting was bought by Mr G. B. Schley.

Another painting (owned by Mrs Arthur V. Hoornbeek of Ellenville) is *The Floating Bridge* (CAT. 380; FIG. 213). Very fortunately Mrs Hoornbeek has the written description given her by Mr Henry as it was written by him, and which Mrs Hoornbeek has allowed me to copy.

THE FLOATING BRIDGE ACROSS THE SCHUYLKILL, PHILADELPHIA

This bridge was made of logs and planked over and floated on the river, being anchored to prevent it from moving with the current. Generally it sank a little when a heavy weight passed over it, causing the water to run over the bridge and the rims of the wheel. If vessels wished to pass up or down, the bridge was unfastened at one end, allowed to drift down the stream with the current and afterwards hauled back and secured at the shore end.

This picture of this stage was made from a drawing in a book of the time, Mellish's Travels in North America, *and shows what a heavy cumbersome affair it was. It had four cross seats with no backs except the rear one, and no way of entering it except by a step over the front wheel and then climbing over the front seat. The "Stage Wagon" was drawn by four horses and often carried the mail. And whatever luggage the passengers carried was generally in small parcels and placed under the seats.*

It was hard riding, roads very rough and traveling in those days (unless by private conveyance) very wearisome. This route south by land was from New York across the Jerseys by stage to Philadelphia. Then by this route from Philadelphia to Baltimore, via Chester, Wilmington, Delaware, and was the only route south except by sea in "sailing packets."

An excellent account of the above can also be found in Twining's Diary in *America,* 1795–1800, *republished a few years ago in New York. E. L. Henry, 1918.*

Mr Henry always tried to give some deeper meaning to a painting than to show just a pleasing picture. So he stepped away from the general subjects of the country wagon when he painted the very modern painting, *Contrasts* (CAT. 371; FIG. 178). His idea was to represent the extremes in life. The small reproduction in black and white cannot show the full meaning he wanted to convey.

[This painting tells its story clearly.] The automobile and people in it portraying all the ease, luxury, wealth and comforts of living for the comparatively few; the hard-working woman with her bare-footed children, her face seamed with lines of care and the heavy responsibility of life; the expression of longing for something in *her* life of what the other had; the little cigar-box wagon with the wheels made of spools; the old rag-doll in the girl's hand; the meager surroundings; the fat pampered dog with a big ribbon bow on its head safe in the car, not wanting to meet in the open the shabby mongrel who on the contrary would be only too glad to meet him in battle. Many asked him to change the car for the old country wagon, saying it was lacking in picturesqueness, who cared for the automobile in a picture? Who wanted it? [It was] modern, commonplace. But his idea was the story he told in *Contrasts*, the great contrast in the lives of some—"some to work, some to play." But after all which life speaks the more eloquently of what life and its needs really are?

St Mark's Church-in-the Bouwerie (CAT. 381; FIG. 215) is the last large painting he ever painted. The Bowery at this time was the "Boston Road." Traveling from New York to Boston and vice versa was by coach. We of today can hardly realize that then pigs were the scavengers of the city. I can remember the ragman with his dogcart and bells hung on a string coming through the street, crying "Rags, rags!"

While Mr Henry was at work upon this picture, he would go down to the church day after day with sketchbook and pencil to make sure every architectural detail should be correct. He felt these old churches and their surroundings represented much of New York's history. St Mark's had its historical value as well as St Paul's, St John's, St George's and others. He could not write a history of them. But at least he could leave behind him a pictured history of them, for he felt that perhaps in the not so far distance they might meet with the same ultimate ending of St John's, and then these pictures would be valuable for reference. Coming years will show the result of his work.

The Artist

His method of painting was very painstaking, that is, in careful detail. Nothing annoyed him more than to see a wheel, a bit of architecture etc. carelessly drawn or out of keeping with the time it was supposed to portray. Often artists would come to him for help in the picture they were at work upon, asking him if such and such a thing was correct. As usual any near piece of paper and little pencil [would be seized] and he would quickly illustrate the correct thing needed.

I remember once an artist coming in his studio and, seeing a finished painting on the wall, asking if he could copy it. Mr Henry, with a very peculiar and quizzical expression on his face, allowed him to do so, such a request being rather uncommon in artist's etiquette.

He was very liberal, however, in his likes and dislikes of others who painted in a different school, and I have often seen him standing before a painting of Manet and finding many things in it to admire. Only it must have some originality in it, for he had no patience with copyists.

He was very quick to see a subject, but very deliberate in painting. He would be walking in the street when he would see something that would attract his attention. [Then he would] make a little drawing of it in his sketchbook or on any little piece of paper in his pocket, going indoors to elaborate it a little, then get canvas and make still another drawing with charcoal. Corrections if needed would be made now, then when satisfactory [he] would draw or paint it in outline, then rarely change it again. He often said he could always see the whole picture fully finished when he commenced. It was only to get it on canvas as he saw it.

This only applies to his smaller out-of-doors canvases. The large historical subjects would seem to flash in his mind and be drawn on paper. Then what study of books, places, dresses, character. The paintings of *The First Railroad Train* and of an *Election of 1842* were maturing in his mind fully ten years before he even commenced his drawing, and oh! what infinite patience it took for perfection.

St Mark's was a labor of love. In truth everything he painted was a labor of love; for he lived in his painting. People and places [from the past] were real [and] living to him. He used models of course all the time, people all around him; but they only represented the *character* he wanted.

The people in his paintings and on his canvas were to him truly alive. Village streets and the country scenes which he loved so to paint, of course, were all from the immediate time; but an old chair, an old clock, an old piece of china, was full of memories of those who had used and handled them. He saw so much; yes! in the present, too, as well as in the past.

He loved the village street, but it was much more often the little village street of a bygone generation. Old carriages, the call being made in them before the door, men and women standing by the side, it all seems quaint to us today; but it was not then, and he, as he painted them, lived in that time.

The Man

I do not think he would ever voluntarily enter any argument which might be going on, unless it might be on art, architecture or perhaps some question of an early period of furniture, vehicle, drawing of wheel or in fact anything pertaining to early colonial life, where indeed his opinion was often asked as he was considered an authority. As it was always easier for him to make a little drawing of what he wanted to describe, out would come a bit of pencil which he always carried, an envelope or handy margin of newspaper, and I wonder how many of these little drawings are still in existence, for they were so often preserved by the one he was talking with.

One evening at the Salmagundi Club there had been a dinner given for an artist or guest. As he was one of the oldest artists there and perhaps representing a special period of art, he was suddenly called upon to make a speech for which he was utterly unprepared.

Looking at the younger men who were very critical of his manner of painting, he said:

"It seems to me that I can see a long bench. Many years ago I was sitting at the near end of it. I was full of ambition, aspiration and dreams; but someone coming in I moved down, and he took my seat. Then another coming in, that end seat was given to him, and I moved on again. Then another and another came, taking that end seat again and again. The place I occupied was taken.

"It seemed only such a short time ago when I sat up at that end. But now at last I am way down, and soon my last place will be occupied by another. Looking back at that other end, I can

see new bright faces as they come in full of life, full of brilliant hope. Along the line faces had grown older as they moved down the bench, life becoming more serious to each one. Their dreams were changing, too, somewhat, perhaps; their eyes were seeing more distant beauty, methods of work were changing."

Then speaking more directly to them, he said:

"You younger men of today look upon the art of the early Hudson River School as old and antiquated. But you who are now on that end of the bench where I once sat, must move on and still again move on. Younger men will take your places. The art of this your day will change, too, for changes are in everything around us. You too will meet with harsh criticism by and by.

"Think of this and remember each year is pushing you on, and by and by you will be looking back as I am. Remember this, and be kindly in your thoughts of those who have gone before you. Think of them not with ridicule of their way of painting the beautiful, but as the men who opened the way which you are walking in now. Your method of work is different; but it all leads up, up into the great realm of art."

He was very fond of collecting not only everything that would be useful in his work; but an old mahogany table, chair, desk, clock, even old china, not only had value to him for its age and beauty of workmanship, but he would draw some story or some allegory from it.

At a dinner given to him on his 75th birthday, after many kind wishes and congratulatory speeches, he in answering [spoke somewhat as follows:]

Often, as he wound up the old tall clock which stands in the hall of his home in Cragsmoor, he thought it seemed so emblematic of life. How well-made and strong it must have been when it left the maker's hands in the early 18th century. How long it had ticked away the many years, months, weeks, days, moments, never losing a moment, just ticking, ticking on and on. But now, after so many years of work, once in a while it would stop and it was necessary to call in the clock doctor, who said some little thing had happened, it only needed a little looking over.

For some time it went on again, almost as well as ever. Then one day it commenced to go a little slower again. The hands did not move quite so easily. They seemed to be getting a little stiffer. The clock doctor was sent for to see it. Looking it over again, he said some of the wheels were out of order now, the cogs were getting worn, the clock was getting pretty old.

A few more years passed, and now the bell, which had always been so clear and loud, seemed hushed. Still the old clock ticked on, but slower, always slower, and losing time more often. Again the clock doctor came. He shook his head, saying the clock was very old, he could do but little more for it. All the works were worn out.

Tick–tack–tick–tack. Just a little while longer, and then the old clock stopped. There was no more use sending for the clock doctor now. For the old clock's work was finished.

This is not my story. I have only tried to tell it as he told it, the story the old clock told him.

Mr Henry was very fond of having his friends come to see him. His hand was always outstretched in welcome at his door, and a warm bright smile on his lips. People have written me, [asking] can they come to see the home where he lived, his studio where he painted so many of his pictures. Oh yes! But the dear hand with its warm clasp of welcome, the bright personality which made the visit so pleasant, is no longer there.

The old clock still stands in the hall as he left it. It is a very old clock; but still its slow solemn tick–tack–tick–tack tells me of quickly passing time. Yet as I wind it, I know it will not be long before its long work will be done, and the old clock will stop for evermore.

Appreciation

Mr Henry was a member of the Lotus Club, the Salmagundi Club, the Union League Club (where he served on the art committee for some time), the Century Club, of course one of the older members of the Academy of Design, the Water Color Society, the Artists' Fund [Society] and the New York Historical Society, when it was on Seventh avenue near Tenth street.

But as he grew older, he grew more fond of his own fireside. Feeling he could not go to all the meetings of the different societies, he resigned his membership in the other clubs and only retained it in the Century Club, where he greatly enjoyed meeting of an evening the friends he had known so long.

The passing years took many of those friends away who like him were growing older, so those evenings together became more and more rare. But the "monthly meetings" were seldom missed; the collection of paintings by artist members, the talks on art; the

meeting of friends was not only a very great attraction but also an inspiration as well.

He generally exhibited one or two of his own paintings and liked to hear a criticism upon them. But his shy pleasure was great when strangers asked to be introduced to him and told him of their admiration of his work.

But perhaps I can introduce here better than elsewhere the appreciation in which he was held in this club by copying from the report of the board of management of 1921:

> *Fate has been kinder to the Century membership in 1919 than the year before. But when we read the names, recall the friendly faces and seem to hear again the familiar voices which were so long a part of the club's intimate life, we begin to understand how much it is personality that counts.*
>
> *In our group of men of art and letters, the hand has touched lightly as to number but heavily when measured by achievement.* [J. Alden Weir's death had just been spoken of.] *An artist of a curiously different quality ended his career when Edward Lamson Henry died at his home in Cragsmoor. Henry was a painter of American life in its picturesque aspects, past and present. The type of his work was purely national; the interest human and genuinely historic; the touch was always that of the masterly genre artist.*
>
> *The public, quick to recognize and appreciate such work well done, has long been familiar with* The First Railway Train in America and The Erie Canal Packetboat, *even when it had not knowledge of the painter. It understood, as the artist meant it to understand, that the canvas was giving a clear and vivid glimpse of life as it really was, in the United States of 1832 and 1840. To Henry, even an oldtime house or church made its own appeal; his interesting study of the Westover mansion of Virginia is on the walls of our club. But he was fondest of bringing human figures upon his canvases with a realism from which, as one of his fellow-artists said of his oldtime coach arriving at a southern ferry, one actually "feels the wind, the slapping of the water," even "the vexation of the travelers."*
>
> *Mr Henry's house at Cragsmoor was a museum of curios after his own heart and in line with his peculiar genius. A collector of actual stage coaches and postchaises of a century ago stands in a class by himself; and when these unusual relics were supplemented by the actual costumes, the arms, even the tools of that distant period, it is easy to understand how the atmosphere of his mountain retreat, was the atmosphere of his paintings.*

[Pasted into the manuscript here is "A Memorial from the Annual Report of the President, Mr Herbert Adams, N.A., read at the Annual Meeting of the National Academy of Design, April 28, 1920," which reads as follows:

> *No one can doubt the peculiar historic interest as well as the genuine charm of the paintings of Edward Lamson Henry, a full-fledged Academician for over half a century. Mr Henry was born in Charleston, South Carolina, January 12, 1841; was elected an associate in 1867; an academician in*

1869. Although he studied in Paris under Gleyre (that same Gleyre who had perhaps more influence upon the art of Whistler than is generally admitted), Mr Henry's art has a characteristic American quality, no doubt enhanced by his subjects, yet not wholly due to them. In depicting on canvas the manners and customs, the inventions and habitations, the politics and pioneering of his native country during the first half of the nineteenth century, Mr Henry stands unrivalled. His contribution to our art is historic, unique. No other painter approaches him in the delicate delineation of such subjects as The First American Railway Train, *Albany Historical Society.*]

Conclusion

In closing, I realize how inadequate this attempt to tell something about the life and work of Mr Henry is. There could have been much more written; for it was such a full and long life of work. I also realize how I have failed in so much I wanted to write.

Those who knew him intimately knew of the charm of his personality, the unconsciousness of himself which was one of his greatest charms. One must have known him personally to know the quaint, quiet humor which rarely left him, that was in himself.

I have also attempted to answer some of the questions asked me about his paintings, but feel the illustrations I have selected are the better answers. I could only select a very few out of the many he painted, equally important as these. His subjects were chosen not because others might care for them, but he cared for them himself. The men and women of his canvases seemed to move before him as living human beings and were as much alive to him as people of today who still walked, breathed and thought.

He was very broad in his outlook of art and always saw much to admire in the early impressionists. He had great love for music. His love for books, his love of nature, his love of everything human, of everything of beauty, his method of work, I have tried to describe.

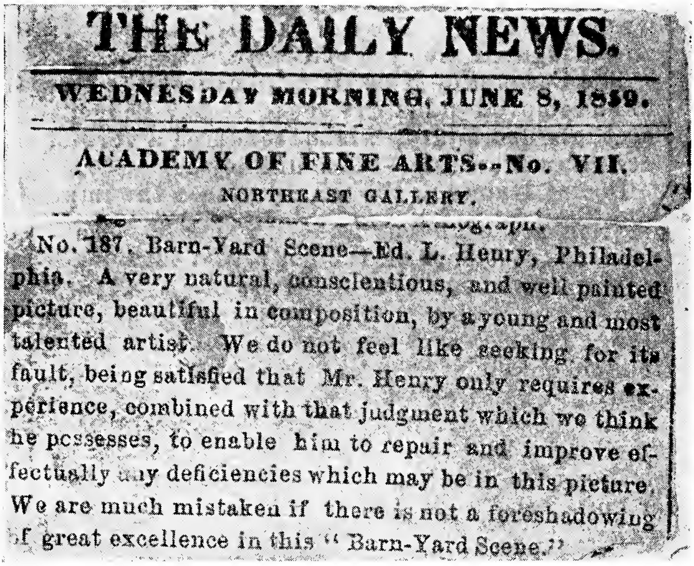
I was asked what influence the school of art in which he painted had upon the art of today; but I do not feel I am capable of answering such a big question as that. But what influence has a Dickens upon the books of today? Is [*sic*] *Nicholas Nickleby, Little Dorritt,* forgotten? What influence have the sweet old songs we still so love to hear upon the music of today: *Home, Sweet Home, Annie Laurie?* In exhibitions, before what pictures do we see the greater mass of people standing the longest? In a country home or the farmer's cottage, is it not some print cut from a magazine or newspaper which tells some simple story we see hanging on the wall?

And in galleries and private collections do not people linger a little longer over the Meissoniers and Knauses?

The last winter of Mr Henry's life was spent in Daytona, Fla. [He was] sent there by his doctor after a very serious sickness. Coming home in the early spring, I asked him if he felt he had benefited by it. He answered so full of enthusiasm:

"Oh, yes, I feel I am still to do my best work!"

Two days after, God called him, and he quietly fell asleep.



THE DAILY NEWS.

WEDNESDAY MORNING, JUNE 8, 1859.

ACADEMY OF FINE ARTS--No. VII.

NORTHEAST GALLERY.

No. 187. Barn-Yard Scene—Ed. L. Henry, Philadelphia. A very natural, conscientious, and well painted picture, beautiful in composition, by a young and most talented artist. We do not feel like seeking for its fault, being satisfied that Mr. Henry only requires experience, combined with that judgment which we think he possesses, to enable him to repair and improve effectually any deficiencies which may be in this picture. We are much mistaken if there is not a foreshadowing of great excellence in this "Barn-Yard Scene."

Figure 228 Henry's first press notice in 1859, slightly enlarged, from the original clipping in the New York State Museum

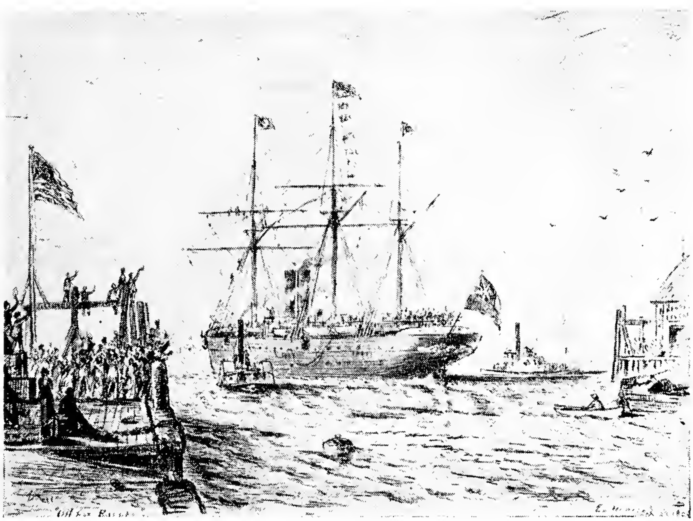


Figure 229 *Off to Europe,* 1860: CAT. 17. A pen-and-ink sketch. Collection, New York State Museum

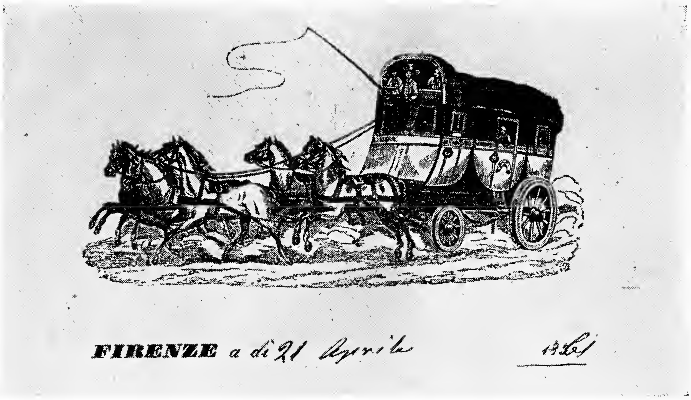


Figure 230 From a ticket for diligence fare from Florence to Genoa, April 21, 1861. Collection, New York State Museum

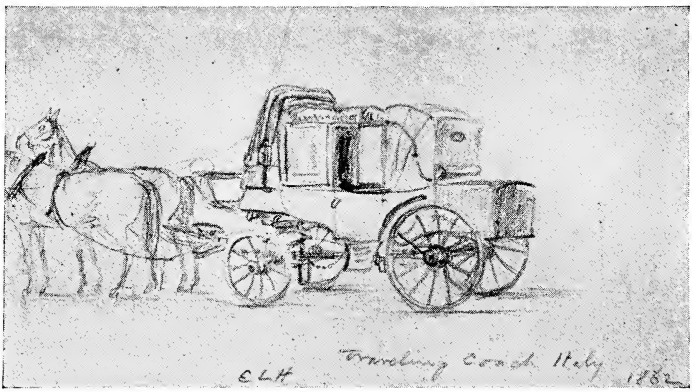


Figure 231 *Traveling Coach, Italy,* 1862. A drawing in Sketchbook 2: CAT. 1186. Collection, New York State Museum

Figure 232 *An Italian Vettura,* 1863: CAT. 34

Figure 233 *In Bella Firenze,* 1861: CAT. 20. Collection, New York State Museum

Figure 234 *Colico, Lake of Como,* 1861: CAT. 22. Collection, New York State Museum

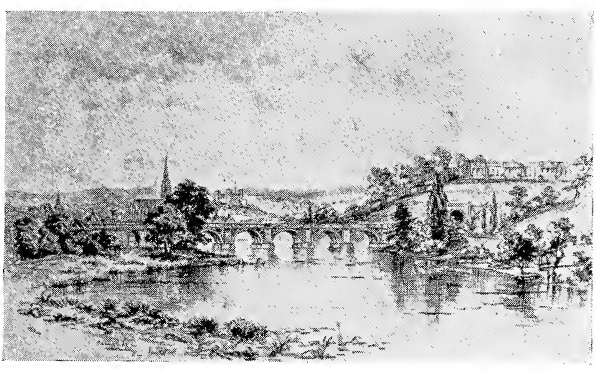


Figure 235 *Cannstadt in Wurtemberg,* 1861: CAT. 25. Collection, New York State Museum

Figure 236 *In Stuttgart,* 1861: CAT. 26. Collection, New York State Museum

Figure 237 *Berlin Omnibus,* 1861: CAT. 27. Collection, New York State Museum

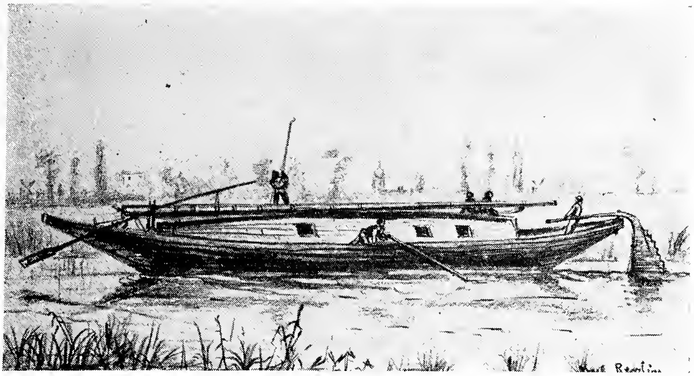


Figure 238 *Prussian Canal Boat,* 1861: CAT. 28. Collection, New York State Museum

Figure 239 *In Amsterdam,* 1862: CAT. 30. Collection, New York State Museum

Figure 240 *Rotterdam,* 1862: CAT. 31. Collection, New York State Museum

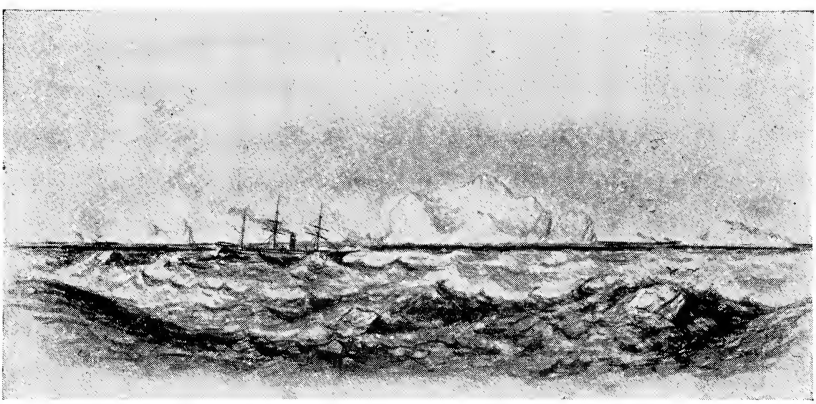


Figure 241 *Icebergs off Banks of Newfoundland,* 1862: CAT. 32. Collection. New York State Museum

Figure 242 *The Clermont,* 1904: CAT. 323

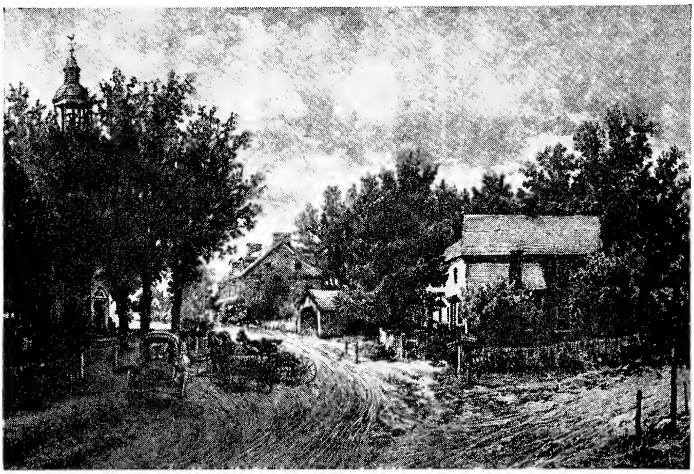


Figure 243 *Near the Brandywine:* CAT. 939. An etching by W. G. Bauer from a Henry painting. Collection, New York State Museum

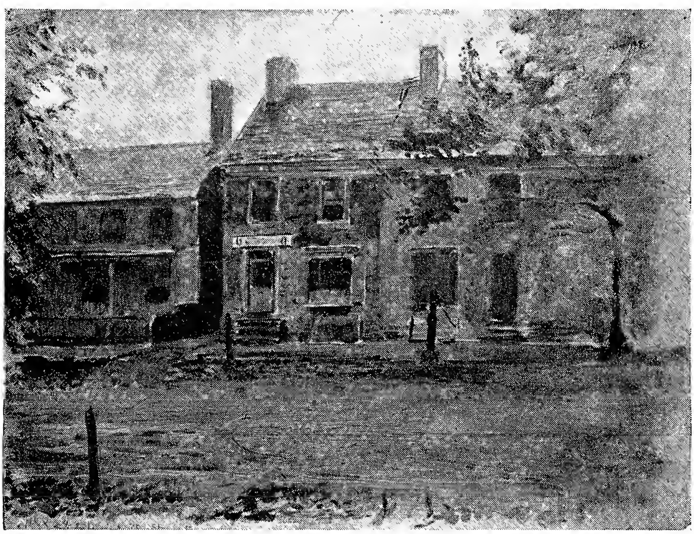


Figure 244 *Stonington:* CAT. 1076. Sketch in oil on canvas. Collection, New York State Museum

Figure 245 *On the Old Gully Road*, 1889–91: CAT. 247

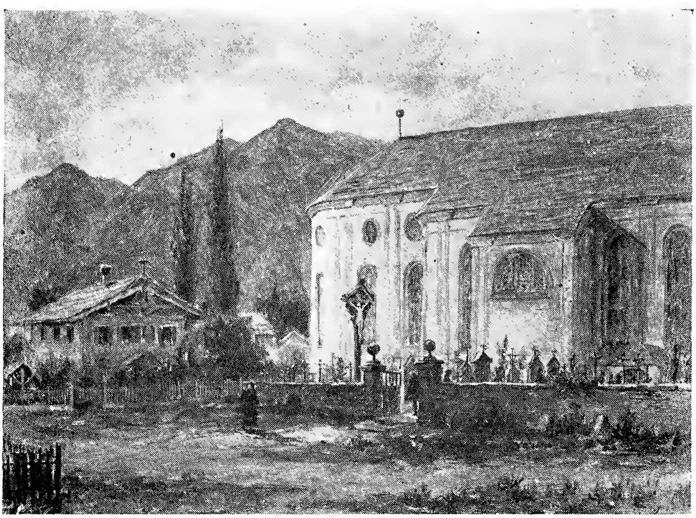


Figure 246 *Study for "Alt Kirche"*: CAT. 1080. Collection, New York State Museum

Figure 247 *St John's Park and Chapel, New York,* 1905; CAT. 324

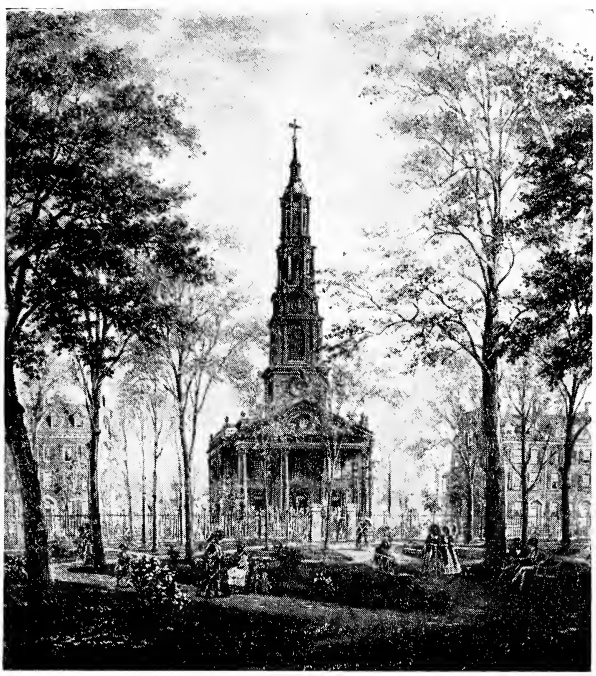


Figure 248 *St John's Chapel,* [1905 ?]: CAT. 325

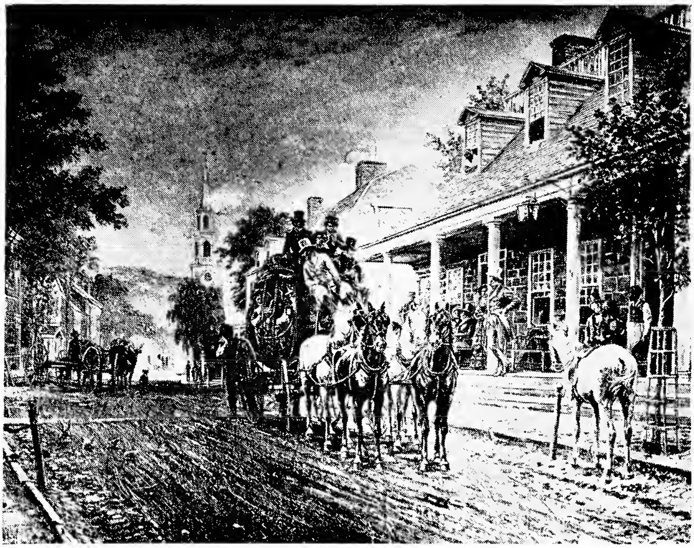


Figure 249 *In the Old Stagecoach Days,* 1907: CAT. 341. Collection, Martin E. Albert

Figure 250 *News of the War of 1812,* 1913: CAT. 366. Collection, Martin E. Albert

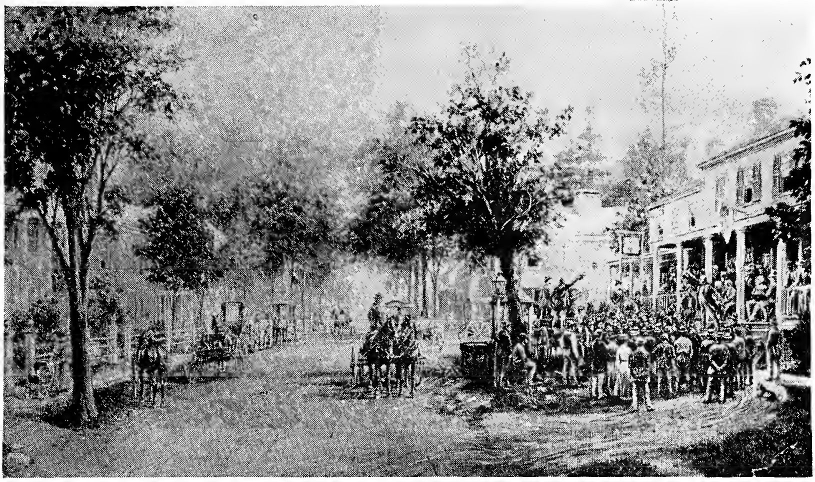


Figure 251 [*Getting Out the Vote*], 1913: CAT. 368

Figure 252 *Election Day,* [1914 ?]: CAT. 373

Figure 253 *Forgotten,* 1888: CAT. 208

Figure 254 *Off the Main Road:* CAT. 941

Figure 255 *Entering the Lock,* 1899: CAT. 289. Collection, Albany Institute of History and Art

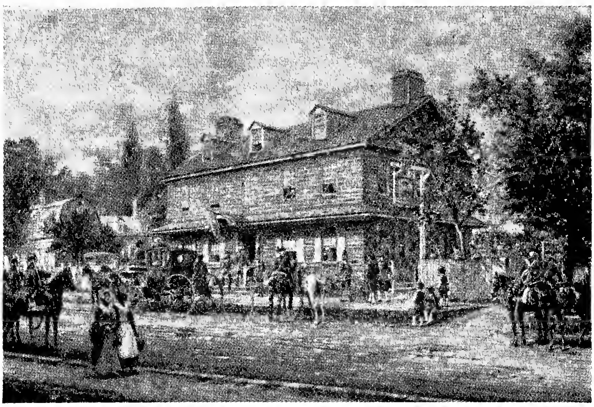


Figure 256 *The MacNett Tavern,* 1904: CAT. 317. From a reproduction in an unidentified catalog. Collection, Albany Institute of History and Art

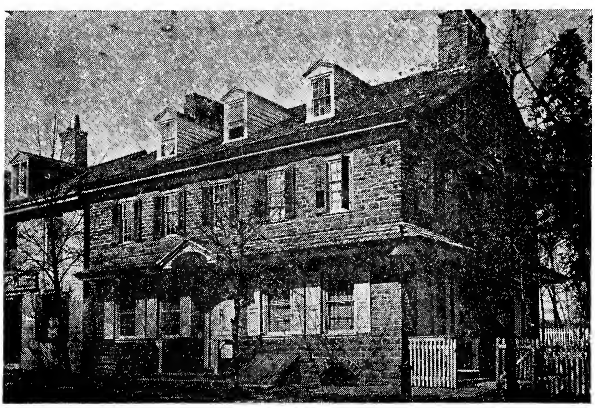


Figure 257 "The MacNett Tavern, Germantown road. Used by Lord Howe as Hd Qtrs . . . Oct. 4, 1777 . . . From Wm Kulp, Antiquary, 1868"

Figure 258 *Tenth Street Studio Building,* 1877: CAT. 132. Collection, National Academy of Design

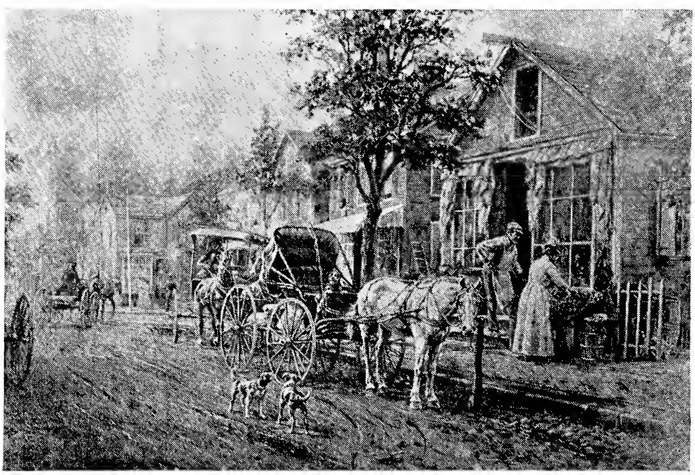


Figure 259 *Marketing Saturday Morning:* CAT. 936

Figure 260 *Happy-Go-Lucky, circa* 1890: CAT. *A*-241. Collection, Guy Mayer Gallery

Figure 261 *What Luck,* 1910: CAT. 941

Figure 262 Mrs E. L. Henry at her Cragsmoor home in 1914

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Titaniferous Magnetite Deposits

of the

Lake Sanford Area, New York

BY

ROBERT C. STEPHENSON

Temporary Geologist

New York State Museum

NEW YORK STATE MUSEUM

BULLETIN NUMBER 340

Published by The University of the State of New York

Albany, N. Y. November, 1945

M372r-O43-2000

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ILLUSTRATIONS

EXPLANATORY NOTE

After the manuscript of this report was submitted to the New York State Museum for publication, approval was secured from the Museum by the author to publish a condensation of the material under the same title. This condensation appeared in Mining Technology, v. 9, no. 1, 1945, as Technical Publication No. 1789 of the American Institute of Mining and Metallurgical Engineers. The more recent views of the author are found in the report appearing in Mining Technology, which contains some minor changes.

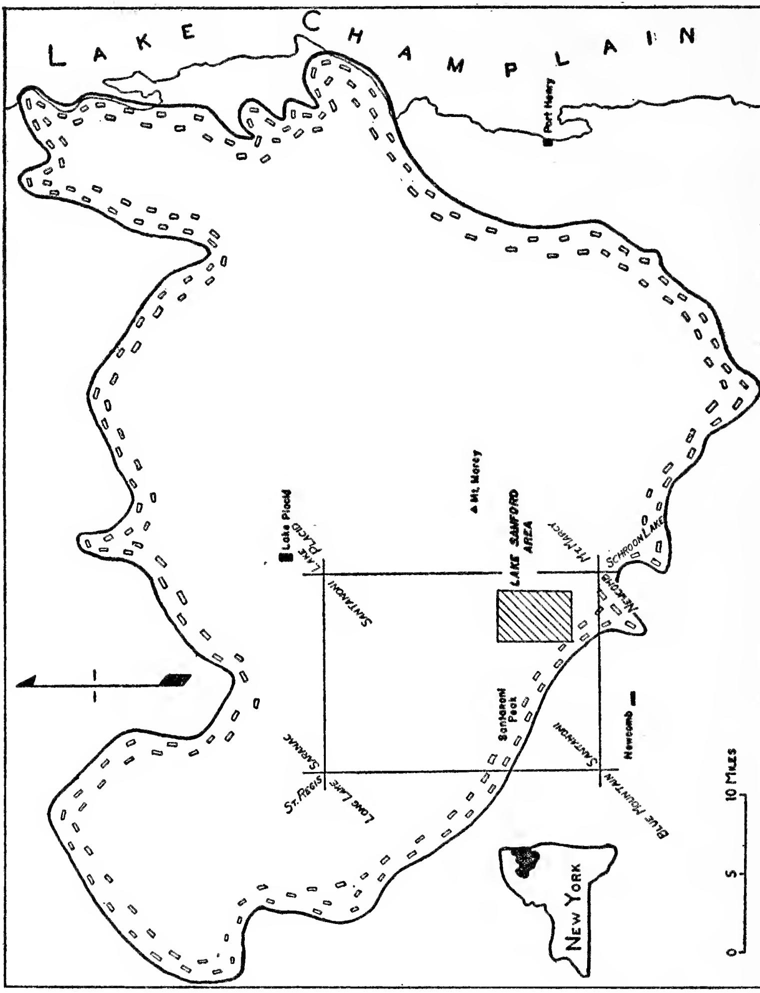


Figure 1 Index map

TITANIFEROUS MAGNETITE DEPOSITS OF THE LAKE SANFORD AREA, NEW YORK

By Robert C. Stephenson, *Temporary Geologist, New York State Museum*

PREFACE

The study of the titaniferous magnetite deposits of the Lake Sanford area has proved to be a very timely investigation. Field work was begun in the area in the summer of 1940. During 1941 the work was sponsored by the New York State Museum. In May 1941 development was started on the Sanford Hill ore body, one of the larger deposits, by the National Lead Company. Imports of ilmenite, classed as an essential mineral by the War Production Board, were virtually cut off during the early months of 1941, due to high cost of shipping and lack of cargo space. The National Lead Company, Titanium Division, a manufacturer of titanium oxides, used chiefly as pigment for light-colored paints, undertook the development at Lake Sanford.

INTRODUCTION

LOCATION

The Lake Sanford titaniferous magnetite deposits consist of a group of ore bodies around Lake Sanford in Newcomb township, near the western edge of Essex county, New York (see figure 1). The lake is in the southeast corner of Santanoni quadrangle. The area lies in the heart of the Adirondack mountains, the most rugged peaks of which rise to the east and north of Lake Sanford. The deposits occur on the heavily forested slopes of the narrow valley of the headwaters of Hudson river, of which Lake Sanford is a part.

The deposits are relatively inaccessible, being approximately thirty miles by highway from the nearest railroad and eight miles from the state highway. The nearest railroad is at the northern terminus of the Saratoga branch of the Delaware and Hudson railroad at North Creek.

The positions of the ore bodies considered in this study are shown on the general geologic map of this area (see figure 2 in rear pocket). There are four separate ore bodies in the area, bearing the following names: Sanford Hill, Ore Mountain, Calamity-Mill Pond and

Cheney Pond. The largest of these, the Sanford Hill ore body, is being developed by the Titanium Division of the National Lead Company for its ilmenite content.

HISTORY

The history of the area is described by A. H. Masten (1923) and W. C. Watson (1869). The discovery of the Lake Sanford deposits dates back to the year 1826 when an Indian led a group of silver prospectors from the North Elba region, across Indian pass, into the Sanford valley. They first encountered magnetite ore at the "Iron dam", a ledge of ore which extended across the Hudson river at the present site of the Tahawus Club.

Six tons of ore were shipped from the deposits in 1831, and tests proved it to make excellent iron. Development work followed these successful tests, and during a brief period in the year 1834 forges were producing 1500 to 2000 pounds of iron a week. With this activity the town of Adirondac sprang up above the head of Lake Sanford, the vestiges of which may now be seen on the grounds of the Tahawus Club.

In 1838 the first blast furnace was built by the enterprise, which was one year later incorporated as the Adirondac Iron and Steel Company. The ore body on the west slope of Sanford hill was first opened in 1839, at which time Ebenezer Emmons (1842, p. 247–63) made an extensive survey of the deposit.

The plant of the Adirondack Steel Company was erected in Jersey City, N. J., in 1848. This, the first cast steel plant in America, utilized iron from the Lake Sanford ore bodies. Steel from this plant was awarded a gold medal at the World's Fair in London in 1851.

It was not until 1848, some 22 years after the discovery of these deposits, that the presence of titanium in the ore was first recognized. Ironically, this element, which contributed largely to the lack of success of the early operators, is now the element which has caused the development of the deposits on a large scale.

In 1854 a new and larger blast furnace was put into service. The remnants of this furnace still stand near the Tahawus Club. The period from about 1850 to 1858 was the interval of greatest activity during the early history of the deposits. Operations came to an abrupt end in 1858 and the deposits remained idle until 1906. The enterprise was reorganized in 1894 as the MacIntyre Iron Company.

From 1906 to 1909 there was extensive development work on the ore bodies. Magnetic surveys of all the ore bodies were made.

followed by considerable diamond drilling. At this time plans were made for a railroad and other necessary production facilities. This epoch in the history of the deposits passed, however, without the production of ore.

A crushing and concentrating plant was erected on the east shore of Lake Sanford at the site of the Sanford Hill ore body to concentrate ore to be shipped for tests in modern furnaces. Some 15,000–20,000 tons of ore were shipped during 1912 and 1913, but transportation difficulties were encountered, as was the case in all previous activities of the Sanford deposits. The test for which this ore was used was run at Mineville under the supervision of F. E. Bachman, general manager of the Northern Iron Company (1914).

A French metallurgist, A. Rossi (1893, p. 838–67), was employed in 1892 to study and improve the methods of smelting titaniferous ores. Patents resulting from this investigation were issued on methods of smelting these ores and also on the manufacture of various titanium alloys. Further work on the ores of the MacIntyre Iron Company led in 1908 to the discovery by Rossi of the suitability of titanium oxide as a white paint pigment. This was the first of a series of discoveries of uses of titanium oxides.

PRESENT DEVELOPMENT[1]

The National Lead Company, Titanium Division, undertook the development of the Sanford Hill ore body in May 1941, acquiring the property from the MacIntyre Iron Company. The development consisted of an extensive diamond drilling program on the Sanford Hill body, accompanied by a dip needle survey; the opening of an open pit mine, and the construction of a concentration mill (see figure 3). In addition a village of some thirty houses, a bunk house and a commissary, all complete with electric lights, running water and a sewage system, were built to accommodate the employes of the company. A road 8½ miles long was constructed connecting the MacIntyre development with state route 28N. Shipment of ilmenite concentrates to the railhead at North Creek started in July 1942.

PREVIOUS STUDY

Early studies of the Lake Sanford titaniferous magnetite deposits were made by Emmons (1842), Kemp (1899) and Newland (1908). Singewald (1913) discussed the details of the physical structure and chemical composition of the ore and observed many of the geologic

[1] Hagar (1941). Titanium and the MacIntyre Development.

features. Osborne (1928*b*), in a study of the titaniferous magnetite deposits of the Adirondacks and Quebec, contributed the most comprehensive information concerning the Lake Sanford deposits and their genesis.

PRESENT STUDY

Seven months during the summers of 1940 and 1941 were spent in the field in the Sanford area. Field work was sponsored by the New York State Museum during the second summer. The 11,000 feet of diamond drill core at the MacIntyre development were made available for study by the National Lead Company.

Laboratory work was based on an examination of 50 polished surfaces and 75 thin sections cut from the drill core and surface outcrops of rocks and ore.

ACKNOWLEDGMENTS

The writer wishes to acknowledge his indebtedness to the Tahawus Club and the MacIntyre Iron Company for permission to examine the deposits of the Lake Sanford area, and to the successors of the MacIntyre Iron Company, the National Lead Company, Titanium Division, and its staff, for much information concerning the MacIntyre development. The writer is indebted to John P. Brand, who served as field assistant during the preparation of control maps of the ore bodies. Thanks are due Professor H. L. Alling of the University of Rochester for the loan of thin and polished sections. Especial thanks are due to the faculty of the Department of Geology, The Johns Hopkins University, for their helpful suggestions and criticisms, and to the fellow graduate students, for the many profitable discussions. The writer also wishes to express grateful appreciation of the cooperation of the New York State Museum in the execution of the study.

GEOGRAPHY AND GENERAL GEOLOGY

TOPOGRAPHY

The Lake Sanford titaniferous magnetite deposits occur in an area of about 12 square miles around Lake Sanford (see figure 2). The lake is a still-water portion of the Hudson river. In the area immediately bordering the river and lake there is very little relief, but hills rise sharply, both to the east and west of this narrow valley. The maximum relief of 2000 feet is afforded by Mount Adams rising to 3584 feet to the northeast of Lake Sanford. Most of the hills rise about 400 to 600 feet above the lake, which is 1720 feet above sea level.

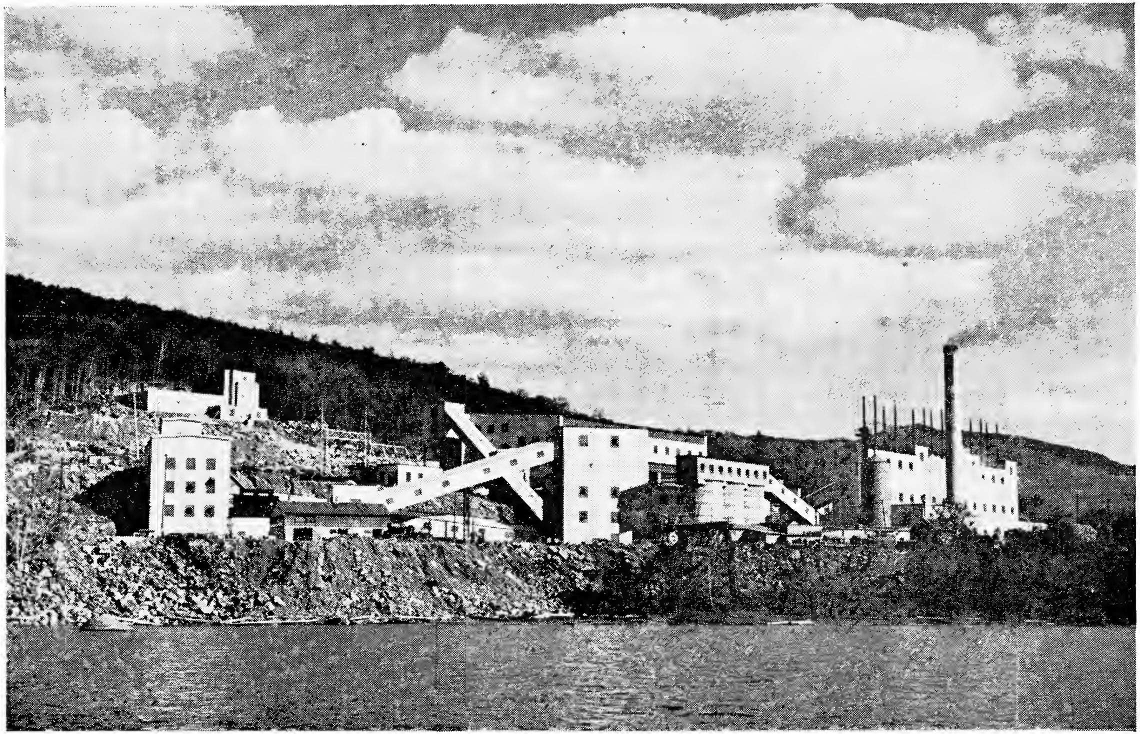


Figure 3 Photograph of the ilmenite concentrating mill of the National Lead Company, Titanium Division, Tahawus, taken from island on Lake Sanford

The slopes of the hills are densely forested with hardwoods and evergreens. Recent lumbering in parts of the area has resulted in the rapid growth of underbrush. Deer and other wild life abound in this area, which lies within the game preserve of the Tahawus Purchase Inc.

The Sanford Hill ore body lies on the southwest slope of Sanford hill. The ore crops out discontinuously from the site of the present concentrating mill near the lake, northeastward for a distance of about 2800 feet up the slope of the hill. Magnetic surveys indicate an extension of several hundred feet, though there are no outcrops. The northern end of the ore body is about 300 feet above lake level.

The Ore Mountain ore body occurs near the foot of the southwest slope of Mount Adams. It extends in a northwest-southeast direction, diagonally to the southwest slope of the mountain, so that the southeastern end of the ore body is several hundred feet higher than the northwestern end.

The Calamity-Mill Pond ore body, as outlined by a magnetic survey, has a length of about one mile. Its south end is at the point where the trail to Mount Adams branches east from the road going north along Hudson river, for about one mile. It terminates on the north at the southwesternmost slope of the MacIntyre mountains. This ore body is confined to the floor of the narrow valley of the Hudson river, Calamity brook and Henderson brook. The ore crops out at, or a few feet above, stream level.

The Cheney Pond ore body lies one and one-quarter miles west of Lake Sanford, on the northeast slope of a hill south of Cheney pond. The hill rises about 200 feet above the level of Cheney pond. The ore outcrops are confined to a narrow zone running northwest-southeast along the northeast slope of the hill.

ROCK TYPES

General Statement

The anorthosite, gabbroic anorthosite, gabbro and titaniferous magnetite are all part of the Adirondack anorthosite massif. The Lake Sanford area is near the southwest edge of this large intrusive body (see figure 1), in the portion described by Balk (1931, p. 339) as the apex of the structure.

Anorthosite

The normal anorthosite is a bluish gray, very coarse, porphyritic rock composed of phenocrysts of labradorite in a groundmass of medium to fine-grained plagioclase and a small percentage

of dark minerals. This rock is essentially the Marcy anorthosite of Miller (1919, p. 17–20). The anorthosite and the gabbroic anorthosite, into which it may grade, comprise the bulk of the rock in the area. The distribution of the anorthosite is shown on the geologic map of the general area (see figure 2).

Gabbroic Anorthosite

The general geologic map shows local areas of gabbroic anorthosite within the anorthosite. The gabbroic anorthosite is composed of labradorite phenocrysts in a groundmass which is rich in dark minerals. The name gabbroic anorthosite is applied to all of the rocks intermediate between normal anorthosite and gabbro. The percentage of labradorite phenocrysts varies between 25 and 15 per cent, and the mafic constituents comprise 15 to 35 per cent of the rock. The gabbroic anorthosite grades into anorthosite but does not intrude it. The rock also grades into gabbro, which in turn grades locally into ore. The gabbroic anorthosite is also intruded by ore.

Gabbro

Gabbro constitutes only a small part of the rock in the Lake Sanford area. It is a medium-grained rock composed of 35 to 75 per cent femic minerals. The rock also contains up to 15 per cent plagioclase phenocrysts similar to those in the anorthosite. The gabbro may grade into anorthosite through gabbroic anorthosite, or it may intrude anorthosite. Usually the gabbro contains the ore minerals which are commonly concentrated in ore-rich bands. The Cheney Pond body is the only large mass of gabbro. The rock commonly occurs as small masses in gabbroic anorthosite and anorthosite.

The titaniferous magnetite occurs as bands disseminated through gabbro, or in rich masses as irregular replacements in anorthosite. It is medium to fine-grained and contains varying percentages of gangue silicates.

Minor Rock Types

Several narrow basic pegmatites which strike east-west cut the gabbroic anorthosite at the mouth of Calamity brook. A few acid pegmatites, never more than several inches wide, cut the anorthosite throughout the area. On Mount Adams a small mass of pegmatite grades with no perceptible boundary into the surrounding anorthosite.

Diabase dikes, varying in width from 14 inches to 10 feet, crop out in the Ore Mountain, Calamity-Mill Pond, and Cheney Pond areas.

GLACIAL GEOLOGY

Much of the area is covered by Pleistocene glacial debris, indicated by blank areas on the geologic maps. These areas lack rock outcrops. No attempt was made to differentiate this material. The largest area of glacial cover embraces most of the region between the foot of Mount Adams, Sanford hill and the Hudson river.

PETROGRAPHY AND MINERALOGY OF THE ROCKS

GENERAL STATEMENT

The anorthosite series in the Lake Sanford area consists of anorthosite, gabbroic anorthosite, gabbro and titaniferous magnetite. These rocks represent a genetically related gradational series and differ from one another primarily in the ratios of the constituent minerals.

The divisions used in the mapping of the Sanford area are as follows: anorthosite, 0 to 15 per cent mafic minerals; gabbroic anorthosite, 15 to 35 per cent mafic minerals, and 50 to 15 per cent plagioclase phenocrysts, and gabbro, 35 to 75 per cent mafic minerals, and not more than 15 per cent plagioclase phenocrysts; ore-bearing gabbro, 10 to 40 per cent ore minerals; gabbroic lean ore, 40–90 per cent ore minerals, and rich ore, 10 per cent or less gangue minerals. The different facies of ore are discussed under ore deposits. Buddington (1939, p. 19) sets up a more detailed division for the Adirondack anorthosite series from anorthosite through gabbro.

ANORTHOSITE

Megascopic Description

The anorthosite is a bluish gray to almost white, granular rock with a very coarse to medium-grained texture. The coarse facies is composed of tabular labradorite phenocrysts in a groundmass of medium-grained plagioclase and a small percentage of dark minerals. The phenocrysts in the coarse facies may be 10 cm or more in length, but they average about 4 cm. Minerals of the groundmass average 1 to 4 mm in size.

The coarse anorthosite may be composed almost entirely of plagioclase phenocrysts and only a small percentage of medium-grained groundmass. This coarse facies commonly grades into medium-grained anorthosite through a decrease in the amount of phenocrysts.

The labradorite phenocrysts are usually blue-gray to gray, and some show the chatoyancy typical of this mineral. The smaller plagioclase grains are light gray, greenish gray, or milky white.

The dark minerals are pyroxene, hornblende, garnet and the ore minerals. Pyroxene and hornblende occur disseminated through the groundmass, while the ore and garnet form aggregates. Frequently small patches of ore are surrounded by a rim of garnet.

Anorthosite grades into gabbroic anorthosite through an increase in the femic constituents and a decrease in the number of plagioclase phenocrysts. Miller (1919, p. 17–20) described the normal anorthosite as containing less than 10 per cent mafic minerals, though locally this figure may rise to 15 or even 25 per cent. The facies with more than 15 per cent of dark minerals is classed as a gabbroic anorthosite in the Sanford area.

Microscopic Description

Texture. The texture of the porphyritic anorthosite is hypautomorphic-granular while that of the medium-grained anorthosite is xenomorphic-granular (see figure 20). The phenocrysts of labradorite usually have a well-defined tabular form. Rounded corners and bent albite twin planes are protoclastic structures common to these crystals (see figure 22). The dark constituents are disseminated through the groundmass or occur as aggregates.

Minerals. The principal mineral of the anorthosite is intermediate plagioclase. Orthorhombic and monoclinic pyroxene, hornblende, garnet, apatite, ilmenite and magnetite are other primary minerals.

Plagioclase. The composition of the plagioclase was determined with the Federov universal stage (Chudoba, 1933), and several determinations were checked by the oil immersion method. The coarse plagioclase crystals of the anorthosite and gabbroic anorthosite show a range in composition from An_{37} to An_{64}, but the majority of the phenocrysts are labradorite, An_{53} to An_{59} (see figure 4). The large phenocrysts of labradorite are probably of intratelluric origin. The medium and small grains of plagioclase in the groundmass of the anorthosite and anorthosite gabbro are somewhat more sodic in composition. The large grains of plagioclase may differ from the groundmass plagioclase as much as An_{10}. These small grains, where they occur in contact with the phenocrysts, resorb the larger grains.

The labradorite phenocrysts have both albite and pericline twinning. The albite twins in many of the large plagioclase crystals are

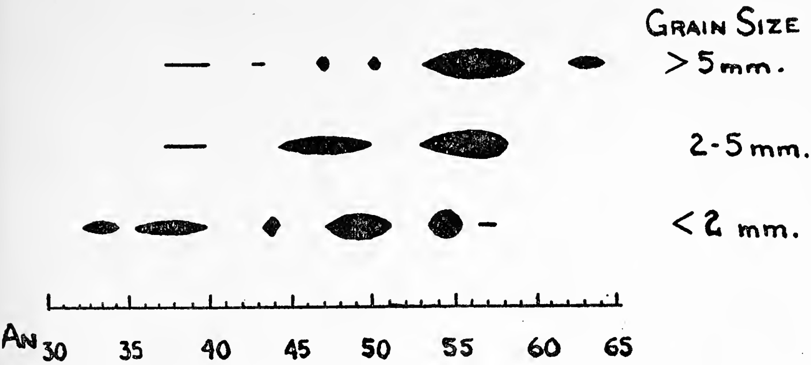


Figure 4 The range in composition of plagioclase grains of anorthosite and gabbroic anorthosite. The percentage of anorthite is represented horizontally, and the relative abundance of a given feldspar is shown by the thickness of the lines vertically.

bent. This suggests that they underwent deformation during consolidation of the rock. Further evidence of this deformation is the ragged appearance of the phenocrysts. Cushing (1907, p. 472) advanced the idea that the anorthosite was granulated in metamorphism. There was a complete lack of mortar structure around the large phenocrysts examined in thin sections from the anorthosite of the Lake Sanford area. This indicates that the material broken from the phenocrysts in granulation must have been reworked by the still unconsolidated portions of the magma. Breaks in the albite twins at the point of bending in some crystals suggest a complete fracturing of these crystals. The breaks are always healed by plagioclase, and hornblende occurs in the plagioclase along some breaks. Evidence favors a theory of protoclastic deformation of the labradorite phenocrysts.

There is no zoning in the plagioclase. Equilibrium conditions must have prevailed throughout the crystallization history in order to have permitted the complete reworking of the early-formed calcic phenocrysts. The relatively small difference in composition of the large plagioclase crystals and the plagioclase groundmass further substantiates this conclusion.

Many of the feldspar phenocrysts have minute inclusions oriented in the plane of the albite twins. Sometimes these inclusions are dustlike, but more often they are rod-shaped. Barth (1930, p. 132–33) reported the common occurrence of minute pyroxene inclusions oriented parallel to (010) in plagioclase of anorthosite from elsewhere in the Adirondacks. The inclusions in the feldspar of the Sanford area are pyroxene, spinel and an opaque mineral, presumably magnetite. The definite orientation of the inclusions suggests that

they were formed later than the enclosing plagioclase. These inclusions are much more abundant at contacts of ore and anorthosite. These facts suggest that the inclusions are formed through replacement along the albite twin planes.

Minute blebs which have the same birefringence, but lower indices than the inclosing plagioclase, occur along the albite twin planes of many plagioclase grains of all sizes and in all the rocks of the series. The blebs are too small to measure for other optical data. They are most likely more sodic plagioclase formed through recrystallization due, possibly, to late magmatic solutions.

Augite. Augite is the most abundant femic mineral in the anorthosite and gabbroic anorthosite. The mineral occurs in subhedral to anhedral grains, which average 2 mm, and is disseminated through the rock or occurs as aggregates. Optical data obtained for the mineral are:

Indices		α = 1.700	Optical character	(−)
		γ = 1.745	2V	70° ± 5°
Birefringence		0.045		
Max. extinction	c $\wedge$ Z	50°	Pleochroism very weak	

According to Larsen and Berman (1934, p. 244), this is a calcium and magnesium rich pyroxene.

Hypersthene. Hypersthene is not common in the anorthosite, but it occurs in small amounts in much of the gabbro and some of the gabbroic anorthosite. It forms anhedral grains which are 1 to 2 mm in size. The optical data for this mineral are:

Indices	α 1.680	
	γ = 1.694	
Birefringence	0.014	
Parallel extinction		
Optical character	(−)	
2V	85° ± 5°	
Dispersion	r > v, very weak	
Pleochroism	X–red	
	Y–pale brownish yellow	
	Z–light green	

Hypersthene with these optical properties has the composition $MgSiO_3$—82 per cent; and $FeSiO_3$—18 per cent (Winchell, 1927, p. 177).

Green hornblende. Green hornblende is present in some anorthosite. It may accompany pyroxene, be formed by hornblendization

of pyroxene, or be present instead of pyroxene. The grains are anhedral to subhedral, and they vary in size from 1 to 5 mm. Hornblende occurs along cracks and boundaries of the pyroxenes, especially the augite. This hornblende is of the same composition as that which has crystallized directly from the magma. Both types occur in the same thin sections. The optical data for this hornblende are:

Indices	$\alpha = 1.658$ $\gamma = 1.672$
Birefringence	0.024
Maximum extinction	$c \wedge Z$ 23°
Optical character	(−)
2V	70° ± 5°
Dispersion	$r > v$
Pleochroism	X-yellow green Y–olive green Z–dark green
Absorption	$X < Y < Z$

These data indicate that this mineral is pargasite which is intermediate in composition between Larsen and Berman's (1934, p. 224–25) numbers 39 and 40, in the hornblende series. The ratio of Mg:Fe is 1.4:1 and of Al:Fe is 4.5:1 in this hornblende.

Garnet. Garnet occurs as grains which are euhedral to anhedral in shape, and are 2–3 mm in diameter. Euhedral and subhedral grains occur disseminated throughout the plagioclase of the anorthosite, but subhedral to anhedral grains in aggregates are not uncommon. Garnet usually occurs in association with anhedral patches of the ore minerals, either as rims around them, or as scattered grains in the plagioclase near the ore patches.

The garnet is pink in color, has high relief and is irregularly fractured. The index of refraction is 1.762, and the specific gravity is 3.62. A garnet with these properties, according to Winchell (1927, p. 264), has the following composition:

Grossularite—$Ca_3Al_2Si_3O_{12}$	72 per cent
Andradite—$Ca_3Fe_3Si_3O_{12}$	18 per cent
Almandite—$Fe_3Al_2Si_3O_{12}$	10 per cent
	100

Apatite. Apatite is not very abundant in anorthosite, but does occur as an accessory mineral. The grains are usually about 1 mm in size and are subhedral to anhedral in shape. The crystals may

be short and prismatic, but more commonly are completely anhedral. Optical data for this mineral are:

Indices	$\epsilon = 1.628$; $\omega = 1.631$	
Birefringence		0.003
Parallel extinction		
Optical character	Uniaxial	(−)
Colorless		

The indexes of this apatite are slightly lower than those of common fluor-apatite (Larsen and Berman, 1934, p. 228), but this difference is probably due to slight impurities.

Ore minerals. Small anhedral opaque patches of the ore minerals are not uncommon in the anorthosite. These patches measure as much as 1 cm in diameter but are usually much smaller. Their shape is always very irregular. They may or may not be surrounded by a zone of garnet.

Secondary alteration minerals. Secondary alteration minerals of the anorthosite are scapolite, chlorite, and carbonate. Scapolite forms as an alteration product of the plagioclase (see figure 21) and usually occurs as scaly aggregates along the borders of the grains. The plagioclase grains are especially susceptible to scapolitization along the albite twin planes. Rogers and Kerr (1933, p. 251) speak of scapolite as a high-temperature alteration product of plagioclase in some gabbros. The optical data of the scapolite are:

Indices		$\epsilon = 1.545$ $\omega = 1.564$
Birefringence		0.019
Parallel extinction		
Optical character	Uniaxial	(−)
Colorless		

These optical properties indicate the scapolite composition is $Ma_{57}Me_{43}$ (Ma—Marialite, $Na_4Al_3Si_9O_{24}Cl$, and Me—Meionite, $Ca_4Al_6Si_6O_{27}C$), and the mineral is dipyrite (Winchell, 1927, p. 346–47).

Pyroxene and hornblende are commonly altered to chlorite. The chlorite is closely associated with calcite, which is a very common alteration product of plagioclase. Chloritization of the femic minerals is so complete in places that the primary mineral can no longer be identified. Calcite and minor amounts of chlorite occur along cracks and cleavages of the plagioclase. Epidote, which usually accompanies chlorite and carbonate in saussuritization, was not found.

The optical data for the chlorite are:

Index	$\beta = 1.604$
Birefringence	low
Optical character Biaxial	(−)
2V	almost zero
Typically forms rosettes	
Color green, slightly pleochroic	

The optical properties are those of prochlorite (Winchell, 1927, p. 376–80).

The following optical data for the carbonate determine it as calcite:

Indices		$\epsilon = 1.488$; $\omega = 1.658$
Birefringence		0.170
Optical character	Uniaxial	(−)
Colorless		
Rhombic cleavage		

Paragenesis.

The plagioclase phenocrysts of the anorthosite were the first crystals to form. It has been pointed out that they are probably of intratelluric origin. The ground mass of the anorthosite crystallized after the intrusion of the magma which carried these suspended crystals. The sequence in which the minerals appear to have crystallized is as follows: plagioclase, apatite, hypersthene, augite, hornblende, garnet and ilmenite-magnetite (earliest to latest).
hornblende, garnet and ilmenite-magnetite (earliest to latest).

The difference in composition of the plagioclase of the phenocrysts and that of the groundmass, and the fact that the large grains are resorbed by the smaller crystals, clearly established the plagioclase of the groundmass as younger than that of the phenocrysts.

Apatite forms anhedral to subhedral crystals along boundaries between the smaller plagioclase crystals, but it is never included in the plagioclase. Apatite anhedra are common as inclusions in hypersthene and augite, so it is assumed that the apatite followed the crystallization of plagioclase and preceded the pyroxenes.

The pyroxenes are always anhedral against the plagioclase and commonly corrode it. It seems likely that all or most of the plagioclase was crystallized before the pyroxene began to crystallize. Hypersthene is often lacking in the anorthosite, but when present, it is in small anhedral grains which are frequently corroded, and inclosed by augite. While this evidence is not conclusive that the hypersthene is earlier than augite, such a sequence is in accord with the evolution of rock minerals as set forth by Alling (1936, p. 202).

Hornblende replaces pyroxene. This fixes its position with respect to pyroxene in the paragenetic sequence. It is formed by peritectic reaction between the pyroxene and the still unconsolidated portion

of the magma. Bowen (1933, p. 114–15) points out that new-formed amphibole will accompany the transformation of pyroxene into amphibole. The amount of hornblendization may be very small, but, many thin sections of anorthosite contain hornblende and no pyroxene.

Alling (1936, p. 202–3) stresses the importance of hyperfusible constitutents in the formation of hornblende, since addition of silica and water are necessary for formation of amphibole from pyroxene molecules. Bowen (1917, p. 209–43) points to the lack of hornblende in the anorthosite, with special reference to the Morin anorthosite, as evidence of the lack of volatile constituents, but Alling (1932, p. 193–237) contests this assumption. It appears that some hyperfusible components must have concentrated in the anorthosite, locally at least, or there would have been no hornblende-bearing anorthosite.

Garnet follows hornblende in the paragenetic sequence but crystallized before the ore minerals which were the last of the primary minerals to crystallize. Garnet corrodes and embays the pyroxenes and hornblende. It commonly occurs as subhedral to euhedral crystals along boundaries of plagioclase and may penetrate it along cracks or along the albite twin planes. Garnet is embayed by ore minerals wherever they occur together.

Garnet is seldom lacking in the anorthosite, but it is most abundant where there is a concentration of ore minerals. It is quite likely that garnet is formed by peritectic reaction between plagioclase crystals and the still unconsolidated ore residuum. The calcium-iron-aluminum composition of the garnet is in accord with such a hypothesis.

The magnetite-ilmenite patches are the last of the primary minerals to form. The ore minerals corrode and embay all of the primary minerals. There is no question but that they are the latest of these minerals. This is in accord with the conclusions of Newhouse (1936, p. 29).

Alteration of plagioclase to scapolite is apparently associated with the occurrence of magnetite and ilmenite in anorthosite for the two frequently occur in the same rock and scapolite is common in the reaction zones between ore and anorthosite. The exact position of scapolite in the paragenetic sequence is not known; it may be slightly earlier than, contemporaneous with or later than the ore minerals.

Chlorite and carbonate are distinctly later than the ore, for in addition to occurring as common alteration products of the rock minerals, they occur along cracks in the ore minerals. The chlorite and scapolite represent a stage of hydrothermal activity which apparently closed the crystallization history of the magma.

GABBROIC ANORTHOSITE

Megascopic Description

The gabbroic anorthosite is a light gray porphyritic granular rock. It consists of tabular phenocrysts, averaging about 4 cm in length, in a medium-grained groundmass. Phenocrysts comprise 15 to 20 per cent of the gabbroic anorthosite. The minerals of the gabbroic anorthosite are identical in composition to those found in the anorthosite. Gabbroic anorthosite, in addition to having fewer phenocrysts than normal anorthosite, has from 15 to 35 per cent mafic minerals in the groundmass, while anorthosite has less than 15 per cent of these constituents. Gabbroic anorthosite is an intermediate member between anorthosite and gabbro, and this facies embraces all gradations between the two.

A small area of the gabbroic anorthosite along the southeast shore of Cheney pond is syenitic in character. The groundmass of this rock is light pink in color and there are only a few plagioclase phenocrysts. This facies has not been delineated on the geologic maps since it occupies an area of only a few hundred square feet. The syenitic facies grades into normal gabbroic anorthosite to the north along the shore of Cheney pond and to gabbro on the south, toward the ore body.

Microscopic Description

The minerals and mineral relations, except for the relative percentages, are the same for gabbroic anorthosite as for anorthosite.

The syenitic facies of gabbroic anorthosite is composed of andesine plagioclase (An_{45}), 55 per cent; microcline, 25 per cent; hornblende, 15 per cent, and magnetite-ilmenite. There is some chloritization of the hornblende. The paragenesis in this rock is: plagioclase (early), hornblende, microcline, magnetite-ilmenite and chlorite.

GABBRO

Megascopic Description

The gabbro is gray when fresh, but it is usually deeply weathered to a brown, limonite-stained rock. It is a medium to fine, granular rock. The grain size varies from 0.5 mm to 3 mm. The gabbro is normally equigranular, but a few tabular plagioclase phenocrysts may be scattered through it.

Gabbro contains 35 to 75 per cent mafic minerals and less than 15 per cent plagioclase phenocrysts. It may grade into gabbroic anorthosite through a decrease in mafic minerals and an accompanying increase in plagioclase phenocrysts, or into ore through a decrease

in silicate minerals and a corresponding increase in ilmenite and magnetite.

Ore-rich gabbro is similar to gabbro in texture but contains 10 to 40 per cent ore minerals, and gabbroic lean ore contains 40 to 90 per cent ore minerals in a rock of texture similar to gabbro. Lenses of rich ore are common in, and usually gradational with, gabbro.

There is a small area of hornblende gneiss above the lens of ore comprising the Cheney Pond body. This grades into normal gabbro in places. The principal minerals of this gneissic rock are hornblende, plagioclase and ore minerals. The texture varies from that of the normal gabbro to very coarse, individual crystals of hornblende reaching a maximum size of 7 mm.

Microscopic Description

Texture. Gabbro is fine to medium-grained, hypidiomorphic-granular. Photomicrographs (see figures 25, 26, 27, 28 and 29) illustrate the texture. The femic minerals commonly occur aggregated in synneusis texture (Vogt 1921, p. 321) (see figure 26). Often crystals are elongated parallel to the foliation of gabbro.

Minerals.

Plagioclase. Large phenocrysts of plagioclase are not common. When they do occur, they are usually resorbed around the borders by small plagioclase grains just as in the anorthosite. The small grains of plagioclase are xenomorphic granular and are commonly from 1–4 mm in size.

The composition of 65 plagioclase grains in thin sections of gabbro from the Sanford area is represented in figure 5. The range of the

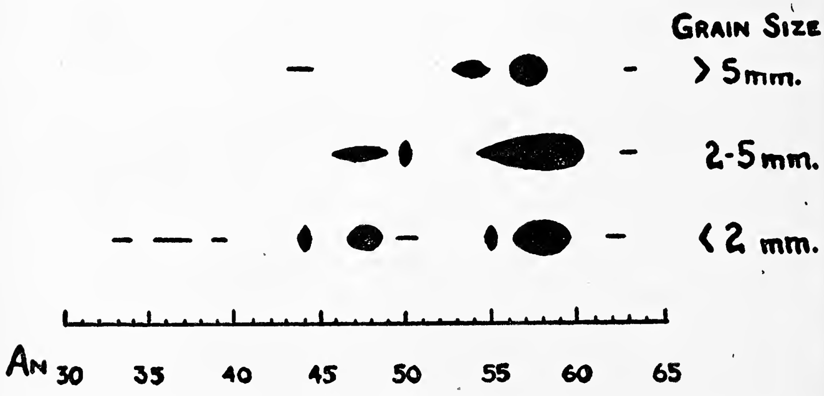


Figure 5 The range in composition of plagioclase grains of gabbro. The percentage of anorthite is represented horizontally, and the relative abundance of feldspar of a given composition is shown by the thickness of the lines vertically.

plagioclase in the gabbro is from An_{63} to An_{33} but most of the crystals fall within An_{60} and An_{45}. The average plagioclase of the gabbro is labradorite, An_{57}. It is significant that the small crystals of plagioclase do not show a more albitic composition than the phenocrysts which are scattered through the gabbro in minor amounts. The phenocrysts were undoubtedly few enough in number to be completely reworked to the same composition as the small crystals. In the mafic facies of gabbro, the composition of plagioclase is commonly An_{58} or An_{59}, about An_2 more anorthitic than the average labradorite of the gabbro. Plagioclase in the hornblende gneiss at Cheney pond is andesine.

A very little plagioclase in the gabbro contains inclusions of mafic minerals along the albite twin planes. Blebs of recrystallized sodic plagioclase, described in the discussion of plagioclase of the anorthosite, are very abundant parallel to the albite twin planes in the ore-rich facies of gabbro. This suggests that the blebs are of deuteric origin and are associated with the stage of the consolidation of the ore minerals.

Alteration to carbonate along cleavages and cracks in the plagioclase is not so common as in anorthosite.

Hypersthene. Hypersthene is not very abundant in normal gabbros, but in ore-bearing gabbro it may comprise as much as 25 per cent of the rock. The composition of the hypersthene in the gabbro is the same as that in anorthosite.

Hypersthene occurs in small anhedral to subhedral crystals. It forms poikilitic inclusions in the diallage of some of the more mafic gabbro, and occurs interlaminated with diallage along polysynthetic twins in the latter.

Diallage. Diallage, rather than augite, occurs in much of the mafic and ore-rich facies. The grains vary from 1 to 3 mm in size and are anhedral to subhedral in shape. Diallage is characterized by schiller inclusions, a good (100) cleavage, and polysynthetic twinning parallel to (100). Intergrowths and poikilitic inclusions of hypersthene in diallage are quite common.

Optical data for the diallage are:

Indices		$\alpha = 1.657$; $\gamma = 1.682$
Birefringence		0.025
Maximum extinction	$c \wedge Z$	$-39°$
Optical character	Biaxial	(+)
2V		$60° \pm 5°$
Pleochroism		very weak

Diallage is considered by Ford (1932, p. 559) as intermediate between augite and diopside. It is altered to chlorite in some of the gabbro.

Augite. Augite of the same composition as that found in anorthosite and gabbroic anorthosite, is common in the less mafic gabbro. It forms medium-sized anhedral to subhedral crystals. The augite may be altered to uralite or chlorite.

Green hornblende. Green hornblende occurs as crystals which formed directly from the magma, and also through hornblendization of pyroxene. The grain size averages 3 mm and the grains are usually anhedral. Hornblendization of the pyroxene occurs along cracks, cleavages and borders of grains. In the hornblende gneiss at Cheney pond the grains become fairly coarse and in general are xenomorphic. The green hornblende of the gabbros and hornblende gneiss is of the same composition as that found in the anorthosite and gabbroic anorthosite.

Basaltic hornblende. Brown basaltic hornblende is common in ore-bearing gabbro. The mineral occurs in stubby, subhedral to anhedral crystals of medium size. It is associated with diallage, hypersthene, apatite and plagioclase in gabbros which are rich in magnetite and ilmenite. Brown hornblende forms instead of green hornblende in these rocks. The optical data are:

Indices		$\alpha = 1.674$ $\gamma = 1.713$
Birefringence		$= 0.039$
Maximum extinction	$c \wedge Z$	13°
Optical character biaxial		(−)
2V		80°
Pleochroism		X–yellow brown Y–brown Z–red brown

$X < Y < Z$

According to Larsen and Berman (1934, p. 224–25) a hornblende of this composition contains a small amount of titanium.

Biotite. Red-brown biotite forms from hornblende and also crystallizes as a primary mineral in the mafic, and ore-bearing gabbros. It never exceeds a few per cent. It may occur in medium-sized subhedral crystals in gabbro (see figures 29 and 30), or as an alteration along cleavages and cracks of hornblende. Frequently biotite occurs along borders of patches of ore minerals. Chlorite is a common alteration product of the biotite. The optical data for this mineral are:

Indices		$\alpha = 1.695$; $\beta 1.643$
Birefringence		0.048
Maximum extinction	c∧X	2°
Optical character Biaxial		(−)
2V		near 0°
Pleochroism		X–pale brown
		Y–brown
X < Y < Z		Z–red brown

Biotite of this composition is, according to Winchell (1927, p. 368) lepidomelane, an iron rich variety.

Apatite. Apatite occurs most frequently as small anhedral grains between plagioclase grains. Subhedral prismatic grains also occur. Apatite crystals are commonly included in the pyroxenes and ore minerals. Apatite comprises as much as 10 per cent of the ore-rich gabbro but in normal gabbro rarely exceeds 1 per cent. The composition of the apatite in gabbro is the same as that in anorthosite.

Garnet. Garnet occurs as medium to fine, euhedral or anhedral crystals. In the normal gabbro it is subordinate to pyroxenes in amount, but some of the mafic and ore-bearing gabbro is rather rich in garnet. The garnet frequently occurs as rims fringing patches of ore minerals (see figures 26 and 27), but it may form euhedra along boundaries of plagioclase. The composition of this garnet is similar to that of garnet found in anorthosite.

Ore minerals. Normal gabbro contains an average of 5 per cent of ore minerals; ore-rich gabbro, 10 to 40 per cent, and gabbroic lean ore 40 to 90 per cent. Figures 24, 25, 26, 27, 28, 29, 30, and 31 illustrate the anhedral character of the ore minerals. Magnetite and ilmenite corrode and embay all of the silicate minerals. The ore minerals commonly have a zone of garnet surrounding them, but the ore may occur in contact with plagioclase without reaction minerals (see figure 30). Green spinel frequently occurs along boundaries of ore minerals in gabbroic lean ore (see figure 31).

Spinel. Green spinel may occur in minor amounts along boundaries of ore minerals and as anhedra associated with ore minerals in gabbroic lean ore. The refractive index of the spinel is 1.778, and the color is deep grass-green. The optical data indicate that the mineral is hercynite ($FeAl_2O_4$) containing some MgO. The refractive index of pure hercynite is 1.80, but Winchell (1927, p. 63) reports that hercynite with 13.7 per cent MgO has an index of 1.775.

Secondary alteration minerals. Chlorite and carbonate occur as late hydrothermal alteration minerals as in the anorthosite, but the alteration is not as extensive.

Paragenesis

The paragenetic sequence of minerals in the normal gabbro is the same as in the anorthosite. This is logical since the same minerals are common to both. The paragenetic relations are more difficult to see in the gabbro since the crystallization periods of all the minerals are not far apart. An increase in mafic constituents in the magma resulted in an overlap in the crystallization periods of the plagioclase and pyroxenes.

Diallage forms after hypersthene in mafic, and ore-bearing gabbros. Intergrowths of hypersthene in diallage, such as are found in these rocks are suggested by Vogt (1921, p 319–21), as having formed by exsolution. In addition to these intergrowths and inclusions, there is diallage which has apparently embayed hypersthene. Basaltic hornblende, which is a rather common constituent in the ore-bearing gabbro appears to have formed instead of green hornblende. Volatile constituents in the ore were undoubtedly responsible for the formation of ferric-iron-rich hornblende.

Biotite formed from green hornblende as an alteration product and also crystallized directly from the magma. Biotite is restricted to mafic, and ore-bearing gabbro. It apparently crystallized after garnet for it occurs along fractures in some of the garnet.

MINOR ROCK TYPES

Pegmatites

The narrow stringers with pegmatitic texture at the mouth of Calamity brook consist of magnetite and a chloritized amphibole. The magnetite contains many intergrowths of ilmenite. The amphibole has been altered to chlorite (var. (—) penninite), and the amphibole cleavage is the only indication of the character of the original mineral. Crystals of these minerals average 3 cm in size. Along the borders of dikes is a zone of very fine-grained plagioclase, hornblende and pyrite, about one inch wide. The contact of this zone with the gabbroic anorthosite is sharp. This pegmatite was undoubtedly generated in ore-rich gabbro of the Calamity Brook area.

The small acid pegmatite mass on Mount Adams is composed essentially of orthoclase, quartz and a small amount of biotite, which is very much altered to chlorite (var. prochlorite). The pegmatite is coarse and inequigranular. The pegmatite grades laterally into anorthosite.

Diabase Dikes

The diabase dikes are aphanitic and dark greenish gray in color. A chilled border of about one-half inch wide is visible megascopically.

The microscopic texture of the diabase is ophitic. Labradorite (An_{67}) occurs in a groundmass of pyroxene which is altered to very finely disseminated carbonate and chlorite. The chilled border is a zone of brown glassy material containing numerous spherulites.

STRUCTURAL GEOLOGY

GENERAL STATEMENT

Special emphasis is placed on the structural geology of the Lake Sanford area in an effort to find what influence, if any, the structure of the rocks has had on the concentration and deposition of ore. The technic of Hans Cloos and collaborators for mapping the structural elements of igneous bodies is used in this work (Balk, 1937).

STRUCTURAL ELEMENTS

Primary Flow Structures

Planar flow structures. A planar flow structure is a fabric formed in a rock by arrangement of minerals or groups of minerals into subparallel or parallel planes. Such structures may also be called "flow planes," "banding" or "foliation."

The planar structure of the anorthosite of the Lake Sanford area is commonly very elusive, as pointed out by Balk (1931, p. 315), for the anorthosite of the Adirondack massif as a whole. Plagioclase phenocrysts oriented with the side pinacoid (010) faces parallel form the planar flow structure in the anorthosite. Parallelism of dark minerals in the groundmass of anorthosite is not common.

In the gabbro, planar structure is generally well developed. There is an orientation of both the plagioclase phenocrysts and the minerals of the groundmass to form foliation. The planar structure in the gabbro is good. Dark minerals tend to concentrate in bands or layers. Grains of ore minerals usually show elongation parallel to the plane of foliation as the amount of titaniferous magnetite increases in the facies intermediate between gabbro and ore.

Most of the ore lacks flow structure of any kind. Foliated ore occurs along the border of some of the lenses of ore in gabbro. The grains of ilmenite and magnetite are elongated in the plane of foliation which is parallel to the contact.

Cushing (1907, p. 472), Miller (1918, p. 412), Balk (1931, p. 317) and Buddington (1939, p. 27) have all recognized the foliation in the Adirondack anorthosite as a primary igneous flow structure. The planar structure developed through an alignment of minerals during the period of flowage and crystallization in the magma and records the probable direction of movement within the magma during this period. The foliation in the rich ore suggests that there was movement in the ore during the period of crystallization. The local concentrations of ore are a result of this movement.

Linear flow structures. Linear structures in igneous rocks are commonly formed by a parallelism of needle-like crystals, or by accumulations of crystals in masses with elongated spindle-like shape (Balk, 1937, p. 7–14). Much of the anorthosite in the Sanford area shows a rather obscure linear flow structure which has heretofore gone unobserved. The phenocrysts of plagioclase in the anorthosite are tabular. The side pinacoid or (010) faces are large and roughly equidimensional, while the crystals are rather thin normal to the side pinacoid. The anorthosite has no apparent flow structure where the phenocrysts are not oriented into a foliation. The plagioclase crystals appear to lie at random in the fine-grained groundmass. If the strike and dip of the side pinacoid faces of four or five of these apparently unoriented phenocrysts of an outcrop are recorded and plotted on a projection net, the traces will intersect in a point or nearly so. This point represents the line of intersection of these planes and suggests that the crystals are oriented around a common axis, with the side pinacoid faces parallel to this axis. Figure 6*a* shows how the crystals may lie with respect to the axis, and figure 6*b* shows in projection the traces of the pinacoid faces of these crystals intersecting at a common point.

This lineation is interpreted as a primary flow structure. According to Balk (1937, p. 7–8), solid bodies, suspended in a moving liquid, will orient themselves so that there is dynamic equilibrium of the forces acting along the surface of each particle. Elongated crystals such as hornblende will rotate so that the longest axis of the particle coincides with the direction of flow. The plagioclase phenocrysts of the anorthosite are not elongated but are tabular, so no such orientation is effected when the crystals are suspended in a moving magma. Plagioclase crystals may move in a magma as suspended particles through a cylindrical pipe. Dynamic equilibrium conditions are satisfied where the side pinacoid faces of the tabular crystals are oriented parallel to the direction of flow. For this reason a plagioclase crystal can be oriented in any position around

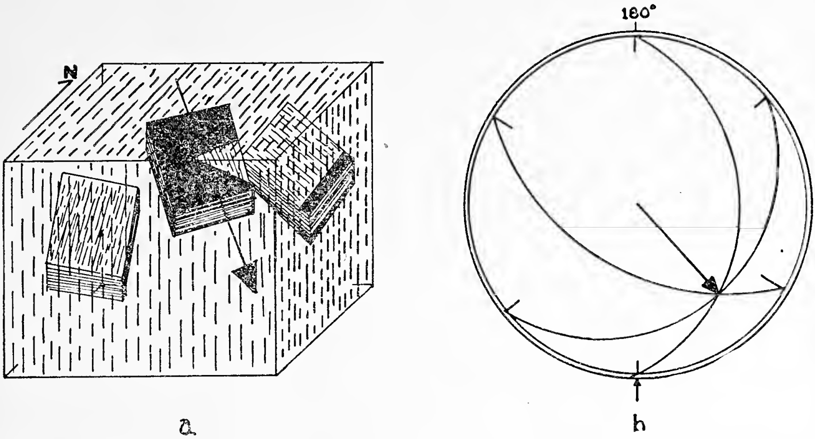


Figure 6 (*a*) A block diagram of anorthosite containing plagioclase phenocrysts with side pinacoids oriented around the axis of flowage. (*b*) Traces of the side pinacoid faces of the plagioclase phenocrysts in (*a*) plotted on a Schmidt equal area net. The planes intersect in a point which contains the axis of flowage.

the axis of flowage as long as the side pinacoid face coincides with the axis.

Plagioclase phenocrysts which are oriented into a linear structure may be rotated into a planar flow structure if the magma in which they are suspended is influenced by wall rock or already consolidated portions of the magma.

CONTACTS

Anorthosite-Gabbro Contacts

Anorthosite almost everywhere in the area grades laterally into gabbroic anorthosite and gabbro without any perceptible boundary. Gabbro intrudes anorthosite along the southwest border of the Cheney Pond gabbro mass and there is a zone of garnet about one inch wide at the contact which is highly irregular. The gabbro dips southwest under the anorthosite. To the east of this Cheney Pond area, the gabbro grades into gabbroic anorthosite.

Anorthosite-Ore Contacts

Contacts between anorthosite and ore are highly irregular and extremely sharp. Ore commonly penetrates anorthosite along joints. Reaction minerals always occur between the ore and anorthosite.

Gabbro-Ore Contacts

Gabbro grades into ore by an increase in ore minerals and a decrease in silicate minerals. Ore is concentrated as bands in gabbro.

At Cheney pond the foot wall of the ore lens with gabbro is sharp. It has a narrow zone of garnet, which suggests that the ore is intrusive into the gabbro.

JOINTS, FAULTS AND DIABASE DIKES

Joints

The Lake Sanford area is but a small portion of the Adirondack anorthosite massif and for this reason a complete analysis of the joints of the region is not possible. There are several systems of steeply dipping regional joints predominating over the entire Sanford area. There is a strong N.E.-S.W. system. There are also quite strong W.N.W.-E.S.E. and minor N.-S. and E.-W. systems.

Local jointing is especially strong in the gabbro, whereas the anorthosite is usually massive. There are many closely spaced strike joints parallel to the foliation plane in the gabbro at Cheney pond.

Faults

There is very little evidence of faulting in the area. Slickensides occur locally on the surface of joints. There is evidence of slippage on practically every joint surface in the south end of the old ore pit above the Tahawus Club, but none of the displacements is over one or two feet. The core from some of the diamond drill holes on Sanford hill shows many slickensides. This evidence of minor displacement occurs in both ore and rock so the faulting must be post-ore.

A small point of land extends into the northern end of Lake Sanford, where the road runs close to the lake. At this point is a flat-lying exposure of anorthosite cut by a 3-inch wide pegmatite which strikes east-west and is nearly vertical. This pegmatite (see figure 7) has been displaced by three vertical faults which trend north-south. The maximum displacement is 18 inches.

The faults may be the result of postconsolidation adjustment in the anorthosite massif, or it may be the result of much later regional deformation.

Diabase Dikes

Four diabase dikes were found in the Lake Sanford area. The dikes trend northeast and are vertical. Their width varies from 14 inches to 10 feet. Two of the dikes occur on the west slope of Mount Adams. Streams have quarried the finely jointed dikes out of the more massive anorthosite. The diabase at the west end of the Ore Mountain ore body is 10 feet wide and a stream has cut a deep walled

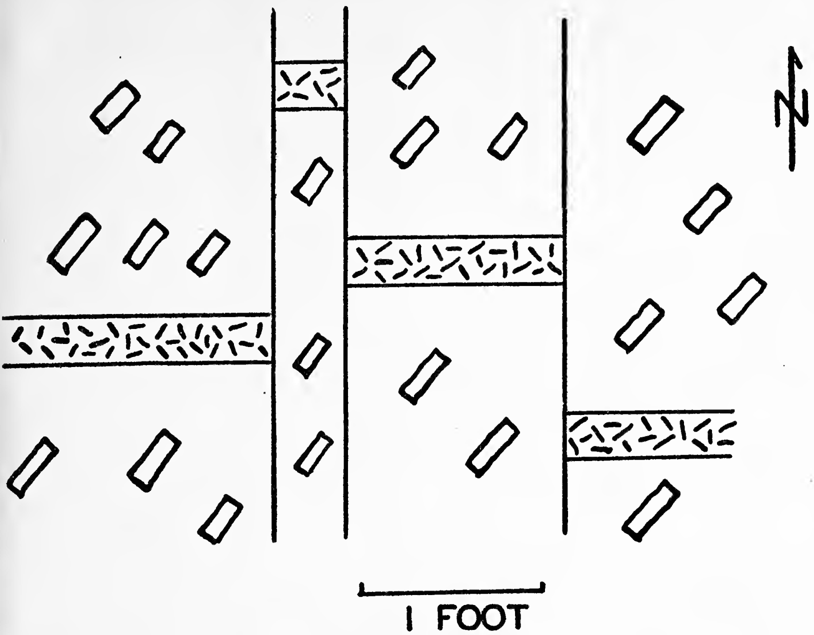


Figure 7 Pegmatite offset by north-south faults. Occurs on west shore at the north end of Lake Sanford.

gorge about 50 feet deep along its strike. A narrow dike is traceable for about 20 feet along the east shore of Cheney pond.

Balk (1931, p. 416) points out that the systems of joints followed by the diabase dikes are probably tension joints. The age of the dikes is considered to be late Precambrian (Keeweenawan) by Buddington (1941, p. 25).

STRUCTURAL GEOLOGY OF THE AREA

General Statement

It has been pointed out that the Lake Sanford area lies along the southwestern edge of the Adirondack anorthosite massif, in the zone which Balk (1931, p. 339) described as the structural apex of the intrusive dome. The Lake Sanford area (see figure 2) is one of very irregular flow structures. These structures were formed in a magma far from the influence of wall rock. Balk (1931, p. 326) described similar irregular structures in the northeastern portions of the massif as festoons.

Planar structure is best developed in gabbro and gabbroic anorthosite, and much of the anorthosite lacks foliation. Linear flow structure is developed locally in areas of anorthosite.

Several portions of the area in between the ore bodies contain small concentrations of ore. Bands of ore occur in gabbro which grades into gabbroic anorthosite on the slope of the hill just to the east of the Tahawus Club. There is a large band of gabbroic lean ore near the crest of the hill which has apparently intruded anorthosite along the foliation plane. The contact is very sharp and garnet occurs along the contact zone.

Gabbroic lean ore occurs in the apex of an intense bend in the foliation of the rocks which outcrop on the thumb of land extending into Lake Sanford directly across from the Sanford Hill ore body. The ore grades laterally on the flanks of the bend into gabbro, which in turn grades into gabbroic anorthosite. The bend in the flow structure apparently served as a concentration point for the ore.

Sanford Hill Ore Body

The Sanford Hill (see figure 8 in rear pocket) ore body is the most poorly exposed of all of the bodies in the Sanford area. Prior to the beginning of development there were only two rock outcrops below the ore body on the northwest slope of Sanford hill. The present study was completed before any of the mine benches had been opened.

Much of the anorthosite on Sanford hill shows no planar flow structure, but the plagioclase phenocrysts are oriented into a linear flow structure. There are several areas where the anorthosite grades into gabbroic anorthosite which usually is well foliated. Structural irregularities in the anorthosite could undoubtedly be correlated with textural variations, if continuous exposures were available for very detailed mapping. Textural changes of the anorthosite occur universally; coarse facies grade into finer facies due to a decrease in the percentage of plagioclase phenocrysts. It is reasonable to assume that the coarse anorthosite, composed mostly of plagioclase phenocrysts in 10 to 25 per cent medium-grained groundmass, would behave as a rigid body much sooner during consolidation than anorthosite or anorthositic gabbro with but 10 to 50 per cent phenocrysts. The areas of coarse anorthosite would thus form obstructions around which the still mobile portions of the magma would move. This may explain the great irregularity of flow structures.

Contacts of ore and anorthosite are very poorly exposed. The solid lines on the map indicate observed contacts and dotted lines indicate inferred ones. The contacts are always sharp and very irregular (see figure 9), and reaction minerals occur between the anorthosite and ore. The contacts are so devious that they can be

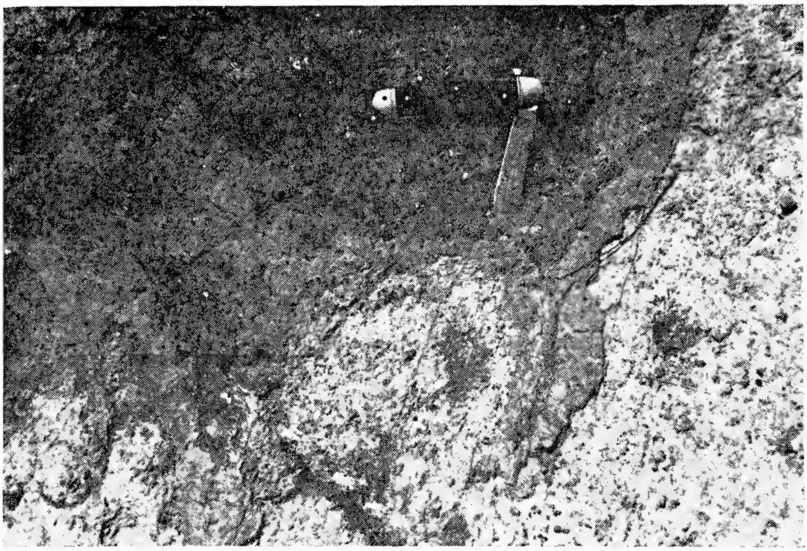


Figure 9 Irregular contact of ore and anorthosite at Sanford hill, with zone of reaction minerals. Photo by Robert Black.

Figure 10 Stringer of ore along a joint in anorthosite at Sanford hill

only generalized on the map. The anorthosite exposed in the excavations for the mill buildings is partially replaced by irregular masses of garnet over 100 feet from the nearest mass of ore. Ore minerals commonly occur as small aggregates in the center of these masses.

Ore engulfs blocks of anorthosite in the old ore pit, which is now the site of the crusher plant. One inclusion of anorthosite, 15 by 12 by 10 feet in size, appears to be completely inclosed by ore and the xenolith has undergone considerable alteration. It has been surrounded by a zone of reaction minerals, and the groundmass has largely been converted to pyroxene and garnet.

Narrow stringers of ore penetrate anorthosite along joints some distance from the nearest outcropping mass of ore. Such a stringer cuts anorthosite on the ridge about two-thirds of the way to the summit of Sanford hill (see figure 10), and the nearest mass of ore is about 200 feet to the west. The average width is two inches and the ore which composes the center one-quarter to one-half inch is separated from the anorthosite by reaction minerals. The ore was introduced after the anorthosite had been jointed.

The only outcropping gabbroic rock which grades into ore occurs toward the north end of the Sanford Hill ore body. Here it is surrounded by ore and occurs as an elongated island of rock. A peg model, constructed with the information obtained by logging the diamond drill core, shows that most of the ore which occurs in the lower part of the hill is in the form of lenses in gabbro. Much of the rock is gabbroic lean ore and ore-bearing gabbro. Lenses of one type of rock can not be correlated from one drill hole to another. This indicates that the lenses are not continuous but pinch out in all directions. Figure 11, in the rear pocket, an isometric drawing of the peg model, shows two large masses of rich ore which are elongated parallel to the general strike of the ore body. These masses occur in anorthosite.

Ore Mountain Ore Body

The Ore Mountain ore body (see figure 12) which lies on the southwest slope of Mount Adams, is very similar to the Sanford Hill body. The ore occurs as rich masses in the anorthosite and as ore-rich lenses in gabbro.

Much of the anorthosite in the vicinity of the Ore Mountain ore body shows only linear flow structure, but locally foliation is developed especially where the anorthosite is gabbroic. The gabbro has a very good foliation.

Ore occurs as bands of varying width in gabbro along the stream on the western edge of the Ore Mountain body and on the hill just a few hundred feet to the east. Low values were obtained for this portion of the body in the dip needle survey by the MacIntyre Iron Company, and these indicate that the concentration of ore is not very great. Gabbro to the extreme east of the ore body shows no bands of ore, but local dip needle anomalies suggest minor concentration of ore.

The richest part of the Ore Mountain ore body occurs in the central portion. The magnetite survey shows that the area of rich ore extends in a southeasterly direction from a point 1200 feet north of the ranger's cabin for 2600 feet to about 1200 feet beyond the telephone line. There are scattered outcrops of rich ore along this narrow zone. Coarse rich ore with sharp contacts against anorthosite occur to the western end of the ore-rich zone, but there are a few lenses of ore in gabbro which outcrop in the central portion near the telephone line. In this area the ore is concentrated where the foliation in gabbro bends abruptly. Massive rich ore grades into gabbro which grades into gabbroic anorthosite in the two stream beds at the southeastern end of the rich central mass of ore. The bands of ore are narrow but closely spaced.

Calamity-Mill Pond Ore Body

The structure in the anorthosite of the area of the Calamity-Mill Pond ore body (see figure 13) is much more uniform than in the vicinity of the Sanford Hill and Ore Mountain bodies. The anorthosite is usually well foliated.

There are no outcrops in the southern portion of the ore body but local areas of magnetic anomaly suggest small concentrations of ore, which probably replace anorthosite. Several small exposures of rich ore behind the Tahawus Club house show sharp irregular contacts with anorthosite.

The relations of ore to anorthosite are well shown in the old ore pit just to the west of the junction of Henderson and Calamity brooks. Coarse-grained rich ore forms very irregular contacts with the anorthosite which constitutes part of the south face and most of the west face of the pit. Singewald (1913*b*, p. 66) describes reaction minerals from the contact zone in this pit which appear to be typical of the contact zones between ore and anorthosite throughout the Sanford area. The ore at the north end of the pit contains xenoliths of anorthosite and individual plagioclase phenocrysts, but

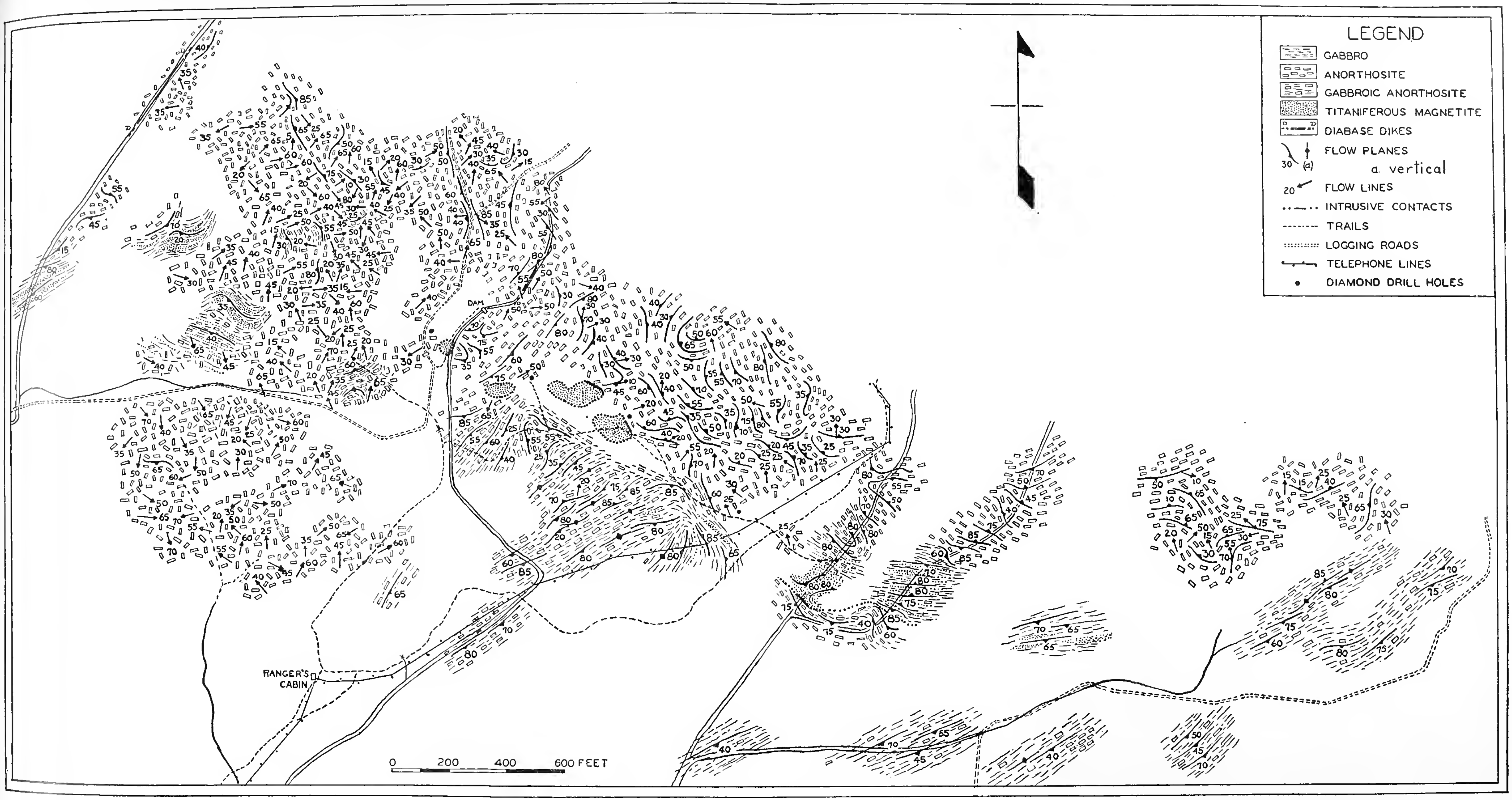
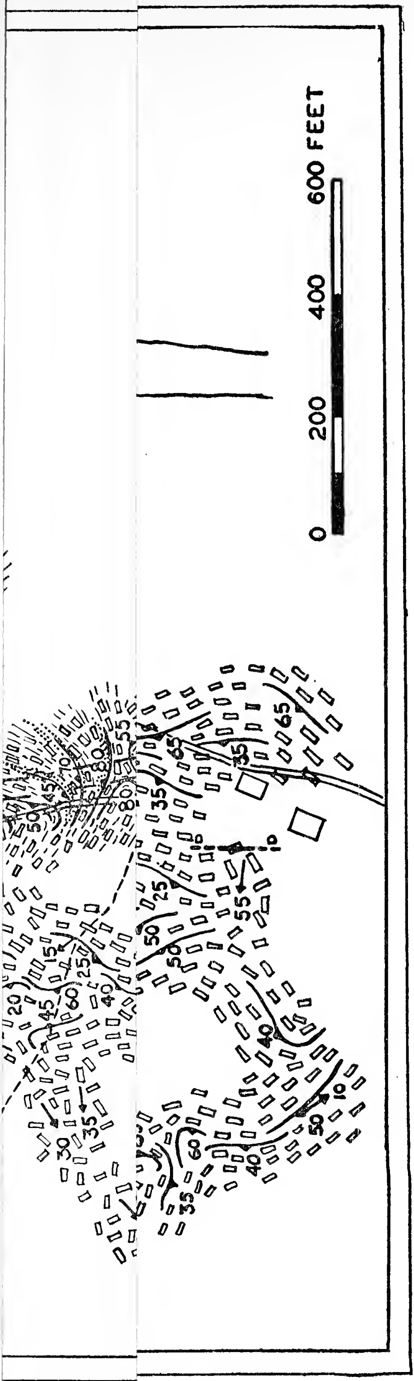


Figure 12 Geologic map of the Ore Mountain ore body



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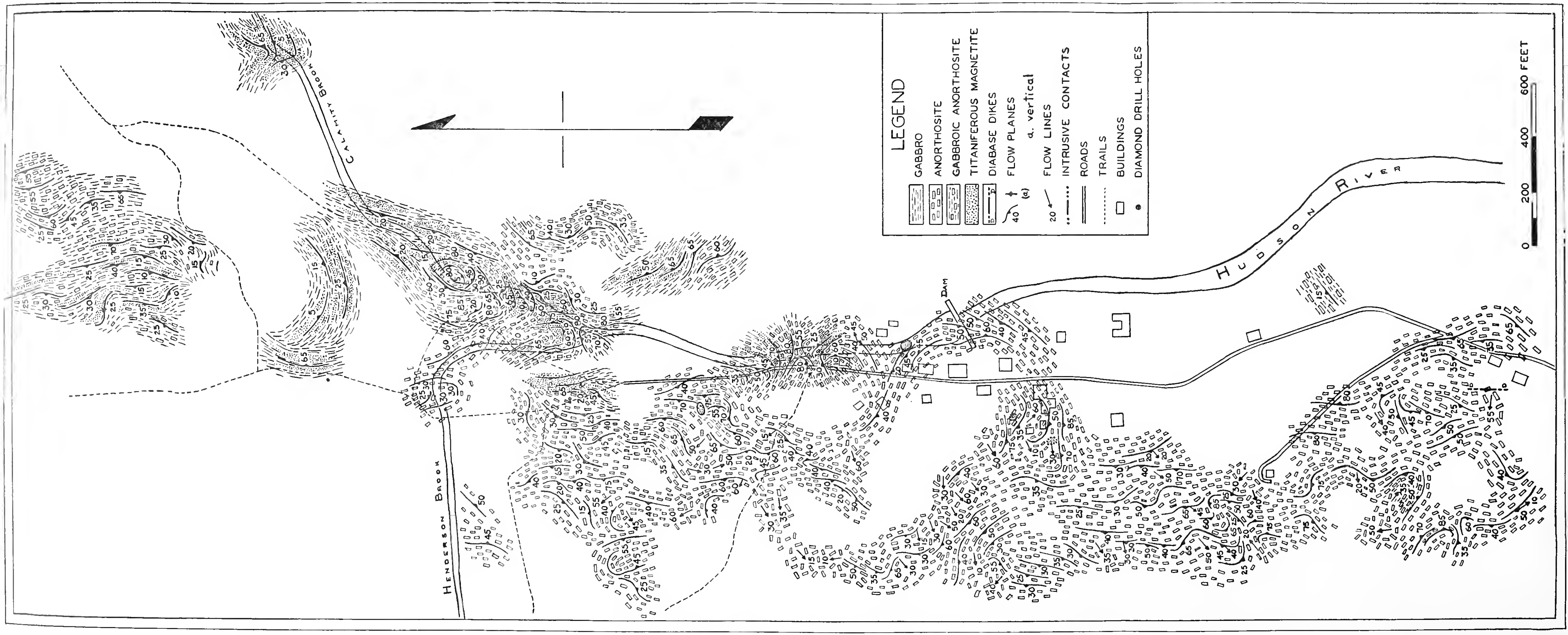

Figure 13 Geologic map of the Calamity-Mill Pond ore body

grades into gabbroic lean ore and gabbro to the south. Slickensides cover almost every joint surface exposed in the pit and suggest that they served as planes of minor slippage. Both anorthosite and ore participated in this adjustment.

Early accounts speak of a dam of ore, the "Iron dam," which extended across the Hudson river at the Tahawus Club. This dam lies about 200 feet up the Hudson river from the dam shown on the map, but today there is only a remnant of it on the west bank. Most of the dam was removed in early mining operations. The photograph (see figure 14) shows ore in the foreground penetrating anorthosite, with narrow stringers which contain mostly garnet and some ore extending into the anorthosite along joints. Very fine-grained ore occurs several hundred feet up the river as bands parallel to the structure in rock varying in composition between gabbro and gabbroic anorthosite. Lenses of ore in gabbro also occur a few hundred feet to the east of the river just north of the Tahawus Club.

The complexity of the occurrence of ore in gabbro is well illustrated along Calamity brook, from the junction with Henderson brook to a point about 800 to 900 feet upstream. The structural pattern formed by detailed mapping is much more complex than the structure suggested by Osborne (1928*b*, p. 740). The ore in this area is associated with gabbro. The ore minerals form bands in the gabbro and occur disseminated through it. The ore is localized in the zone of intense bending of the flow structures. Away from the ore the gabbro grades into gabbroic anorthosite. Veins of lean ore cut across the foliation of gabbroic anorthosite about 300 feet above the junction with Henderson brook. The ore may cut, or grade into, gabbroic anorthosite.

The area north of Calamity and Henderson brooks is fairly level for a distance of 600 to 800 feet. The rock of many of the localities which have rather strong magnetic anomalies is covered with glacial material. Newland (1908, p. 162) describes lean ore exposed by trenching in this portion of the ore body as "lean ore, consisting of disseminated magnetite with feldspar and pyroxene." This description would fit the gabbroic lean ore associated with bands of rich ore cropping out in Calamity brook. The ore of this area north of the junction of the two brooks is all associated with gabbroic rock types.

At the extreme north end of the Calamity-Mill Pond ore body, gabbro and gabbroic anorthosite crop out on the south and east slopes of a hill rising steeply to the north. The photograph (see figure 15)

shows magnetite occurring in sharply defined stringers parallel to the foliation in the gabbro. Such banding of ore in gabbro and gabbroic anorthosite is typical of the rocks outcropping on this hillside.

Cheney Pond Ore Body

The Cheney Pond ore body (see figure 16) occurs in normal gabbro with excellent foliation and does not grade locally into gabbroic anorthosite as does the gabbro which occurs in association with the other ore bodies.

To the east and north of the ore the gabbro grades into gabbroic anorthosite. There is an exposure showing gabbro dipping under anorthosite on the southwest side of the hill. The contact of the gabbro and anorthosite on this side of the hill is sharp. It is exposed in only a few places, but the distribution of the two rocks suggests that it is fairly irregular. There is a zone of fine-grained garnet about one inch wide between the two rocks, but there is no indication of contact action in either. It appears that the gabbro has intruded anorthosite and the flow structure in the gabbro is conformable with this contact.

The gabbro body is synclinal. The cross section (see figure 17) shows the ore concentrated in a lens parallel to the foliation. The dip of the foliation of the gabbro decreases above the lens of ore, suggesting that this is the center of the structure. Singewald (1913*b*, p. 64) reported that drill core from the Cheney Pond body showed gabbro grading into anorthosite at depth. Only one lens of ore crops out but magnetic anomalies suggest that there may be others. The ore in this lens is uniformly fine-grained and contains as much as 40 per cent of gangue silicates.

The hanging wall contact of the lens is nowhere exposed, but the footwall is exposed discontinuously along its length. A narrow zone, about one inch wide, of coarse magnetite and garnet occurs between the gabbro and the fine-grained ore of the lens, and the contact is sharp. The gabbro does not grade into ore by an increase in ore minerals, but the ore probably concentrated in the gabbro below and moved into its present position.

There is an area of hornblende gneiss on the northern slope of the hill, above the lens of ore. This medium-coarse-grained rock grades into normal gabbro. It may have formed from the gabbro by action of mineralizers which aided in the concentration of the ore.

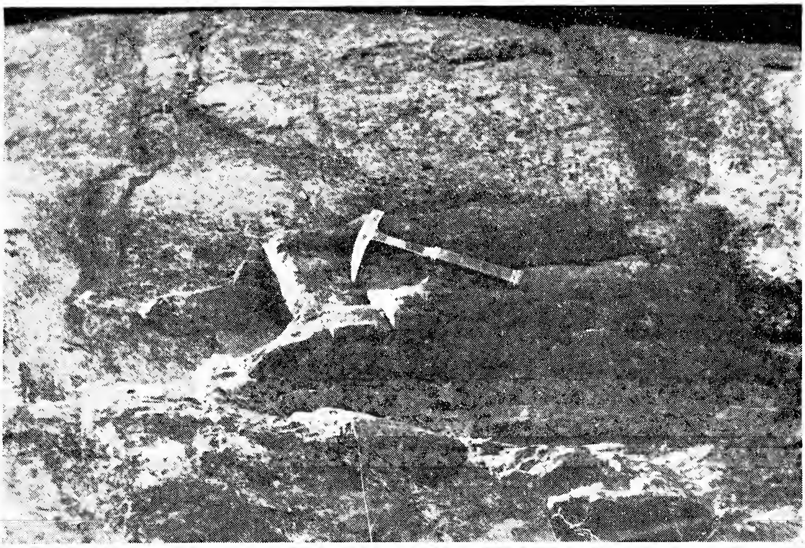

Figure 14 Irregular mass of ore in contact with anorthosite at the "Iron dam," near the Tahawus Club

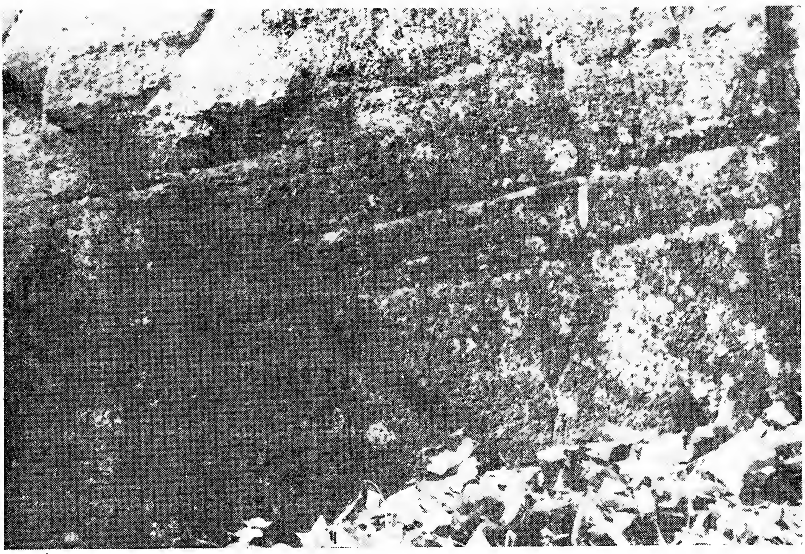

Figure 15 Magnetite-rich bands parallel to foliation in gabbroic anorthosite at the north end of the Calamity-Mill Pond ore body

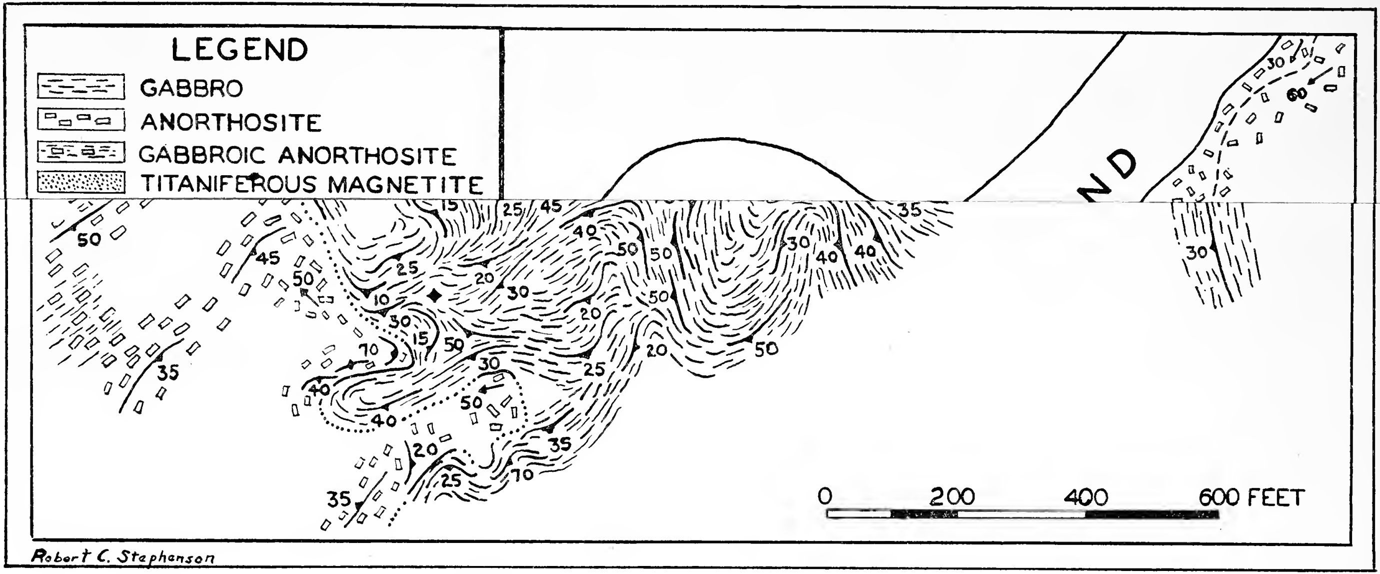

Figure 16 Geologic map of Cheney Pond ore body

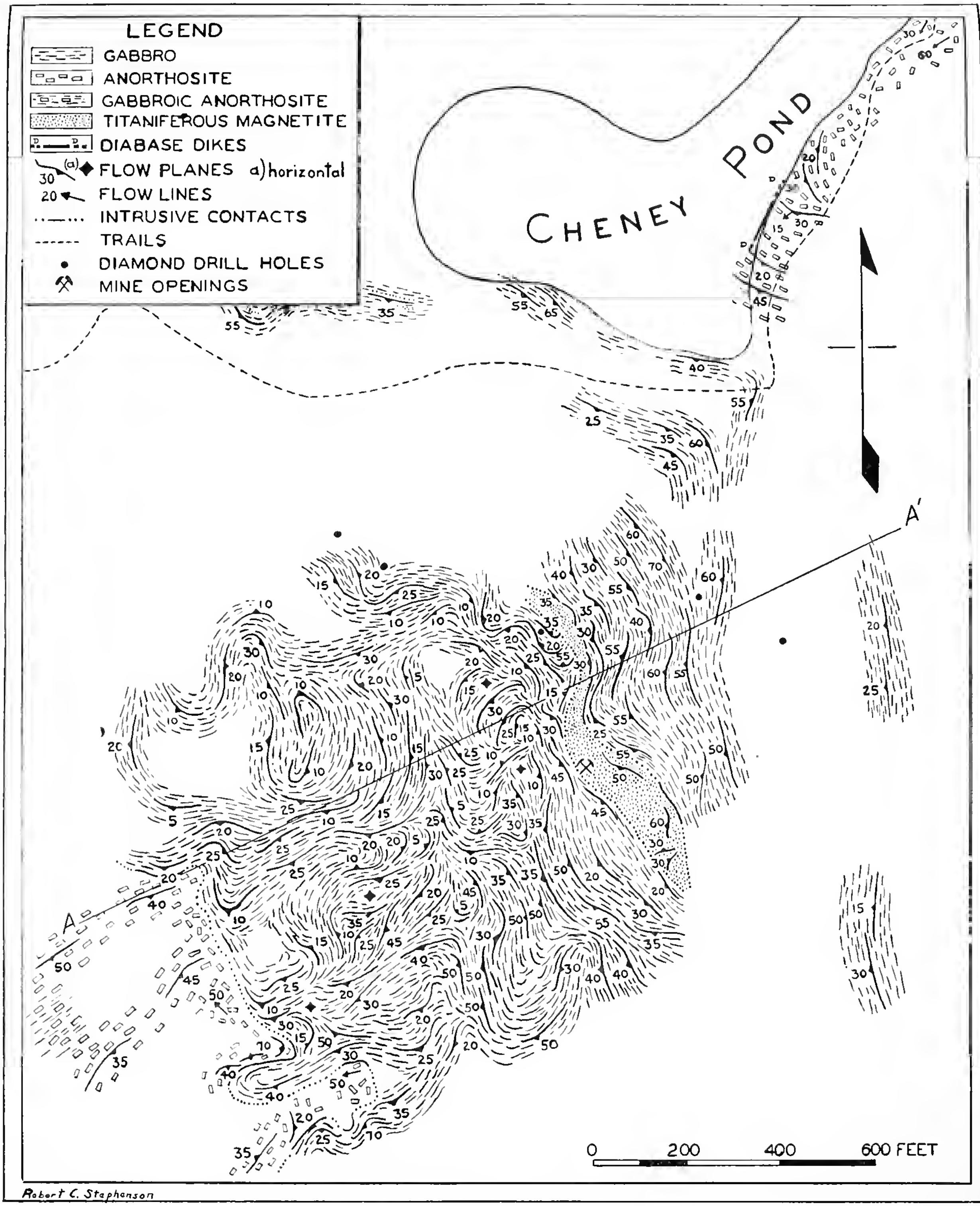

Figure 16 Geologic map of Cheney Pond ore body

There are several outcrops of ore-bearing gabbro just west of the pond, but the area immediately northwest and west of the ore body is entirely devoid of outcrops.

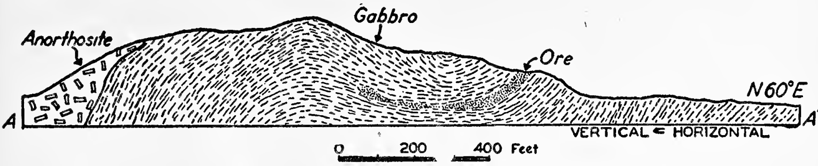

Figure 17 Cross section of the Cheney Pond ore body

SUMMARY OF STRUCTURAL FEATURES

1 The gabbro usually shows good planar flow structure.

2 The anorthosite grades into gabbroic anorthosite and gabbro, but it may be intruded by gabbro.

3 The anorthosite may show either a planar flow structure or a linear orientation of plagioclase crystals.

4 Ore always occurs with sharp, irregular contacts against the anorthosite and may penetrate the anorthosite along joints.

5 Ore grades into gabbro. It commonly occurs as conformable lenses or bands in gabbro and gabbroic lean ore.

6 The flow structures in the area are highly irregular in trend. There are a number of local areas of synclinal structure plan.

7 Ore concentrates in the apex of intense bends in the planar flow structure. The ore may grade into gabbro which in turn grades into gabbroic anorthosite on the flanks of these bends.

8 There are several systems of steeply dipping joints which are probably regional. Diabase dikes occur along the northeast trending joints.

9 There is evidence of minor post-ore displacement along joint surfaces in parts of the area.

PETROLOGIC HISTORY

The great irregularity in the plan of the flow structures of the Sanford region seems to bear out Balk's assumption that it is in the apex area of the asymmetrical dome of anorthosite. It appears that the flow structure in this area was not influenced by wall rock during intrusion but that conditions of turbulent flow existed in the magma. The masses of anorthosite, which were more or less rigid, probably influenced the direction of flow in the gabbro and gabbroic anorthosite portions of the magma to a considerable extent.

Gabbro and anorthosite are the two major rock types. There are no acid rocks in the area other than several small pegmatitic segregations in the anorthosite. The parent magma from which the

gabbro and anorthosite differentiated was probably gabbroic anorthosite. Buddington (1937, p. 255–56) postulated a magma of this composition for the parent magma of the whole Adirondack anorthosite series. It is not the intention to suggest here that the magma of the entire Adirondack massif was of gabbroic anorthosite composition, but it appears that the portion of that magma which intruded the Lake Sanford area approached it.

The phenocrysts of plagioclase are of intratelluric origin. The phenocrysts must have comprised at least half of the gabbroic anorthosite magma prior to its intrusion, for these crystals constitute a major part of the anorthosite. This rock and gabbroic anorthosite make up most of the intrusive mass in the Lake Sanford area. The phenocrysts of plagioclase, which were suspended in the magma, accumulated in masses as the magma was being intruded. A compaction of this "mush" of crystals is evidenced by bent albite twin planes and protoclastic structure of the labradorite crystals in the anorthosite. The phenocrysts of plagioclase probably lagged behind in the intruding magma due to the difference in their rate of flow as compared to the magma medium in which they were suspended. This effected an accumulation. Constrictions in the channelway of the intruding magma undoubtedly served as accumulation points for crystal masses. This process of differentiation is similar to the filter pressing advanced by Balk (1930, p. 292) for the differentiation of the Adirondack igneous complex. In the Lake Sanford area a gabbroic magma residuum was the complement of the anorthosite, rather than a syenitic fraction as proposed by Balk for the whole massif. Buddington (1939, p. 214) suggests that the gabbroic magma is complementary to the anorthositic accumulates in the anorthosite series, but that this complement is small in proportion to the anorthosite.

The Cheney Pond gabbro represents the only differentiate within the Lake Sanford area which is slightly more acid than the rocks of the area as a whole. The anorthosite, gabbroic anorthosite and gabbro of the region show a range in the plagioclase composition of An_{33} to An_{64}, with labradorite having a range of An_{53} to An_{59} predominating. The Cheney Pond gabbro and the gabbroic anorthosite around the pond is composed of intermediate plagioclase which is predominantly an andesine An_{45}. This slight difference in feldspar composition suggests that differentiation progressed a bit further in this area, and the magma at this point was only slightly more acid.

The filter pressing served mainly to split up the magma into portions composed essentially of plagioclase phenocrysts with some interstitial magma and portions containing none or only a small

percentage of these phenocrysts in magma which represented the gabbroic fraction of the original gabbroic anorthosite magma. Further differentiation within this gabbroic fraction probably gave rise to the concentration of titaniferous magnetite lenses in the gabbro.

The gabbro and anorthosite, after being separated by this mechanical method of differentiation, continued crystallizing in equilibrium with each other. The plagioclase crystals in the anorthosite were reworked by the interstitial magma to give them the same composition as the plagioclase crystals forming at the same time in the gabbroic portions of the magma. The smallest grains of plagioclase in the anorthosite and gabbroic anorthosite average about 10 per cent more in albite than the larger crystals with which they are associated. These grains probably used up the final plagioclase constituents in the magma.

The problem of the mode of concentration and localization of the ore minerals into ore bodies is most complex. The ore is genetically related to the gabbro and it is not found anywhere in the Sanford area without this associated rock. Its concentration into bands in the gabbro was effected by fractional crystallization coupled with the difference in the rate of flow of this still mobile portion of the gabbro as compared to the already crystallized silicate minerals. Differentiation *in situ* could not have supplied all of the ore. There were probably portions of the magma already rich in titanium and iron prior to intrusion, and ore deposition was focused at these points.

The anorthosite probably assumed the properties of a rigid body before the gabbroic anorthosite and gabbro, since it is composed largely of the early plagioclase phenocrysts. When the ore-rich gabbros encountered anorthosite masses, ore replaced anorthosite in a very irregular manner and penetrated it along already formed joints. This replacement of anorthosite by ore gave rise to the richest portions of the Sanford Hill and Ore Mountain ore bodies. Even where the anorthosite is replaced by ore, which formed in the gabbro, there are gradations between anorthosite and gabbro. There is not a definite series of chronologic units in the history of the intrusion of the magma but rather a series of overlapping relations.

Following the consolidation of the magma and the development of the jointing, came displacement along joint surfaces. This faulting may have been associated with adjustment which accompanied the cooling of the massif, or it may have been caused by later regional deformation. The faulting was not very intense. The diabase dikes came later, and intruded along northeast trending tension joints in the late Precambrian.

ORE DEPOSITS

GENERAL STATEMENT

Distribution of the titaniferous magnetite ore in the Lake Sanford area is shown on the geologic maps and has been discussed in earlier portions of the report.

CLASSIFICATION

A classification of titaniferous magnetite deposits was proposed by Osborne (1928*b,* p. 735) as a result of his study of deposits in the Adirondacks, Quebec and Ontario. His classification is as follows:

1 Discordant or dikelike bodies
  A In anorthosite
  B In gabbro
  C In other rocks
2 Concordant, sill-like, or stratiform bodies
  A In anorthosite
  B In gabbro
  C In other rocks

The deposits of the Lake Sanford area belong to Osborne's types 1*A,* and 2*B*. The Sanford Hill, Ore Mountain and Calamity-Mill Pond ore bodies include both types. The discordant bodies in anorthosite are related to adjacent concordant bodies in gabbro, for the ore concentrates in the gabbro prior to introduction into anorthosite. Therefore, it is not uncommon to find concordant lenses of ore in gabbro within a few feet of discordant ore masses in anorthosite. Osborne did not recognize the gradation between anorthosite and gabbro which contains concordant lenses of ore. Such occurrences of ore he classes as concordant bodies in anorthosite. Osborne (1928*b,* p. 895–99) erroneously classes the Cheney Pond ore body, which is conformable in gabbro, a concordant body in anorthosite.

MEGASCOPIC DESCRIPTION OF ORE

Ore in Gabbro

Ore occurring in gabbro is hypidiomorphic, and the grain size varies from 1 to 2 mm. Ilmenite grains have a bright metallic luster and irregular fracture; magnetite is dull and commonly shows a prominent octohedral parting. Ilmenite is only slightly magnetic. Ilmenite grains are frequently euhedral and subhedral.

Gangue minerals occur disseminated in the ore and the grain size of the gangue is the same as that of the ore. Feldspar, garnet and pyroxene can be distinguished megascopically. These minerals are

common to gabbro. Gradations from gabbro to ore have been discussed under Petrography and Mineralogy of the Rocks.

The Cheney Pond ore is finer grained than ore found in gabbro of other occurrences in the area, and it carries a higher percentage of rock minerals.

Concentration of ore into bands which grade into gabbro suggests that ore was found *in situ.* Ore was formed in place, but there was some movement of ore along these bands after the adjacent gabbro consolidated. The sharp contact described in the Cheney Pond ore body and flow structure in ore bands near gabbro at Sanford Hill are evidence of this movement.

Ore in Anorthosite

Ore occurring in anorthosite is hypidiomorphic and is slightly coarser than the ore in gabbro. The grain size is 2 to 3 mm. Physical differences of ilmenite and magnetite are the same as for ore in gabbro. Euhedral ilmenite grains in the magnetite are more abundant in this ore than in the finer-grained ore in gabbro. Magnetite grains are commonly subhedral.

Gangue consists of blocks of anorthosite engulfed by ore and individual feldspar phenocrysts. Xenoliths of anorthosite may range from a foot in diameter to much larger blocks. These inclusions are always surrounded by a zone of reaction minerals, of which garnet and pyroxene are most conspicuous. Individual plagioclase inclusions are very common in the ore. They are dark green and are usually surrounded by a very narrow zone of reaction minerals. The plagioclase inclusions are comparable in size to the phenocrysts of plagioclase in anorthosite.

Ore may occur in large masses with little or no gangue. One diamond drill hole on Sanford hill cut through almost 200 feet of solid ore. Other portions of the ore contain many individual plagioclase phenocrysts and xenoliths of anorthosite.

MICROSCOPIC DESCRIPTION OF ORE

Methods of Study

Gangue minerals were studied in transmitted light, but the opaque ore minerals were observed in reflected light.

Properties observed in reflected light included: hardness, behavior on polishing, color, reflectivity, anisotropic effect, behavior on etching, texture and grain size. Principal references describing the technic are: Short (1940), Sampson (1929, 1923), Fairbanks (1928),

Osborne (1928*a*), Van der Veen (1925) and Schneiderhöhn (1922).

Reagents found most satisfactory for etching were warm 1:1 HCl, and concentrated HF. Specimens were etched for periods of 15 to 20 minutes.

Properties of Minerals in Reflected Light

Magnetite

Hardness: Anomalous. May be marked by needle though magnetite can not actually be scratched (Short, 1940, p. 140).

Behavior on polishing: Polishes well, but with difficulty

Color: Gray

Reflectivity: In general low; compared to ilmenite, higher

Reflection pleochroism: None

Anisotropic effects: Isotropic. Intergrowth of ilmenite may give slight anisotropism.

Behavior on etching: Mild etching with 1:1 HCl stains magnetite brown, continued treatment etches magnetite dull black, while ilmenite, spinel, pyrite and gangue silicates remain unetched. Some orientations of magnetite apparently etch more readily than others, (Osborne, 1928*a*, p. 449). Fuming HF does not affect magnetite, but continued treatment with concentrated HF etches magnetite dull black.

Texture: Hypautomorphic-granular

Grain size: 1 to 3 mm. Average about 1.75 mm.

Ilmenite

Hardness: Hard—can not be scratched by needle

Behavior on polishing: Polishes well; some pits

Color: Gray, with brownish tinge

Reflectivity: Lower than magnetite; higher than spinel

Reflection pleochroism: Very slight

Anisotropic effects: Gray to brown. Complete extinction observed at two positions in a 360° rotation. Maximum colors observed when nicol is rotated about 2°. (Sampson, 1929).

Behavior on etching: Negative to 1:1 HCl; stained brown by concentrated HF.

Texture: Hypautomorphic-granular

Grain size: 1 to 3.5 mm. Average size about 2.25 mm.

Spinel

Hardness: Hard, not scratched with needle

Behavior on polishing: Polishes very well

Color: Gray
Reflectivity: Very low
Reflection pleochroism: None
Anisotropic effects: Isotropic
Behavior on etching: Negative to etching with HCl and HF
Texture: Grains anhedral
Grain size: Less than 0.5 mm

Pyrite

Hardness: Hard, can not be scratched with needle
Behavior on polishing: Excellent polish
Color: Pale yellow
Reflectivity: Very high, much higher than magnetite and ilmenite
Reflection pleochroism: Not noticeable
Anisotropic effects: Isotropic
Behavior on etching: Negative to HCl and HF
Texture: Anhedral to ore minerals—forms late veinlets
Grain size: Averages 1.5 mm

Pyrrhotite

Hardness: Scratched readily with needle
Behavior on polishing: Polishes well
Magnetic
Color: Brass yellow
Reflectivity: Much higher than magnetite and ilmenite
Reflection pleochroism: Very slight
Anisotropic effects: Four extinctions in 360°; maximum colors are light gray to dark brown with nicol rotated 3°.
Behavior on etching: Tarnished slightly by 1:1 HCl
Texture: Grains anhedral against ore minerals, but sometimes subhedral against gangue
Grain size: Less than 0.5 mm

Gangue silicates

Hardness: Can not be scratched
Behavior on polishing: Polishes well
Color: Dark gray
Reflectivity: Extremely low
Reflection pleochroism: None; may exhibit internal reflections
Anisotropic effects: None
Behavior on etching: Bleached by 1:1 HCl
Texture: Anhedral to euhedral against ore
Grain size: 1 to 5 mm. Average size 2 mm.

Texture

The average grain size of magnetite is slightly less than that of the ilmenite. The table (see table 1) shows the average grain sizes of the two minerals in 38 polished surfaces of ore from Sanford Hill ore body. Ore in gabbro is finer grained than ore in anorthosite. The ore from the Cheney Pond body has an average grain size of about 1 mm.

The texture of the ore is hypautomorphic-granular unless it contains abundant gangue minerals; then the ore minerals are anhedral to the earlier formed gangue.

Ilmenite and magnetite grains may be elongated to form a flow structure near the boundaries of lenses of ore which occur in gabbro (see figure 15). The ore minerals also form flow bands around small inclusions of gangue in anorthosite (see figures 18 and 45).

The ratio of ilmenite grains to magnetite grains is given in table form for specimens from the diamond drill core at Sanford hill (see

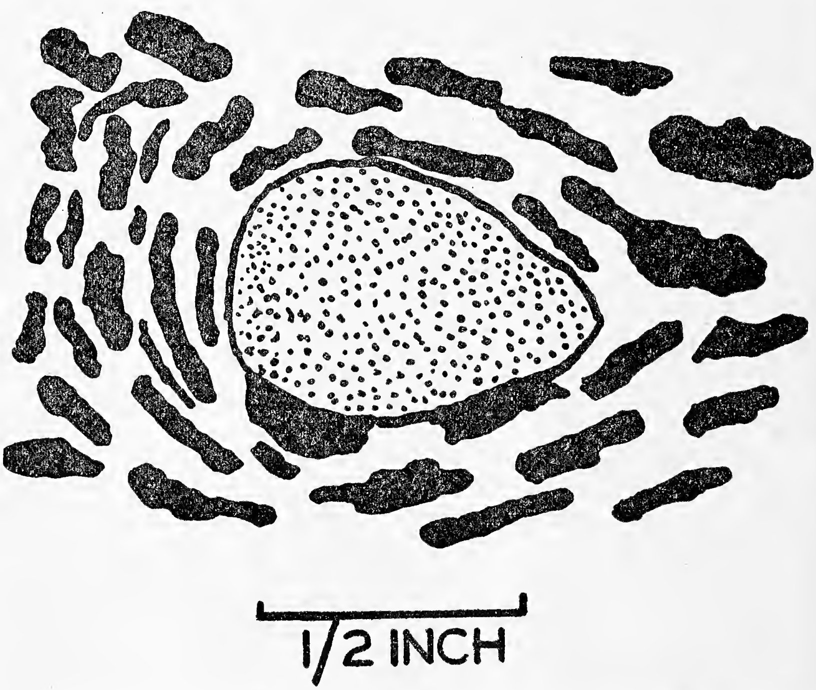

Figure 18 Ore minerals arranged as flow bands around an inclusion of feldspar. Observed on a polished surface of ore. Magnetite, black; and ilmenite, light.

table 1. The ilmenite-magnetite ratio varies too much in individual specimens to make it possible to determine a general ratio for the Sanford ore. Ore in gabbro is apparently higher in ilmenite than is ore in anorthosite.

Mineral Relations

Ilmenite intergrowths in magnetite. In the Lake Sanford ores, intergrowths of ilmenite comprise from 0 to 30–35 per cent of the magnetite in which they are contained (see table 1). Magnetite in ore which occurs in gabbro usually has but a few ilmenite intergrowths. Magnetite of the Lake Sanford ore contains five different types of ilmenite intergrowths. These are:

1 Regular tabular plates of ilmenite parallel to octahedral planes of magnetite (figures 32, 33, 34, 35 and 36)

2 Irregular tabular plates parallel to octahedral planes of magnetite (figures 34 and 35)

3 Minute flecklike intergrowths parallel to octahedral planes of magnetite (figures 34 and 35)

4 *En echelon* intergrowth (figure 35)

5 Irregular concentration between magnetite grains (figures 35 and 36)

The regular tabular plates of ilmenite are much more abundant than any other type of intergrowth.

Presence of ilmenite intergrowths in magnetite has been known for many years. Hussak (1904) reported ilmenite lamellae parallel to octahedral planes in magnetite from Brazil. Singewald (1913*a*, p. 213) described ilmenite arranged as a thin film between magnetite grains. He also noted the tendency of ilmenite intergrowths to be more abundant in magnetite near ilmenite grains, a condition illustrated in figure 38. *En echelon* intergrowths have been described recently by Faessler and Schwartz (1941) in titaniferous magnetite from Sept Iles, Quebec.

It is now generally agreed that intergrowths of ilmenite in magnetite are due to unmixing (Bastin, *et al.* 1931, p. 568–70). Ramdohr (1926) has shown that intergrown magnetite and ilmenite go into solid solution above 800° C. Kamiyama (1929) found that ilmenite from Korean titaniferous magnetite became miscible in magnetite at temperatures above 1125° C., but Edwards (1938) obtained solid solution in Australian ore at temperatures similar to those observed by Ramdohr. Impurities may be the cause of the range in results of these experimental data. Ramdohr concluded that unmixing takes place between 500° and 800° C., and that factors which influence unmixing are the size of the magnetite crystal, the rate of cooling and the presence or absence of mineralizers.

Table 1

Table data from polished surfaces of ore

% Ilmenite intergrowths in magnetite	Relative amount in per cent			Grain size		Important structural and textural relations	Depth	Hole	Specimen
	Gangue	Magnetite	Ilmenite	Magnetite	Ilmenite				
5–7	25	30	45	2.5 mm	Aver. 2.5 mm	Ilmenite grains subhedral, magnetite anhedral. Gangue clustered in patches. Magnetite penetrates ilmenite.	131′ 6″	3	Rich ore 3g
10	20	50	30	....	....	Ilmenite grains subhedral, magnetite anhedral. Magnetite extensively embays ilmenite. Gangue clustered in patches.	108′	4	Rich ore 4r
5	20	45	35	2	3	Ilmenite and magnetite subhedral. Magnetite embays ilmenite along cracks and boundaries. Gangue scattered.	185′	4	Rich ore with Garnet 4f[1]
5	25	55	20	....	....	Ilmenite grains subhedral, magnetite anhedral. Pronounced penetration of ilmenite by magnetite. Gangue scattered.	117′	6	Lean ore rich in dk minerals 6x
8–10	10	40	50	2	2.5	Ilmenite and magnetite anhedral. Ilmenite grains corroded by magnetite. Gangue occurs in clusters.	61′	8	Rich ore 8d
5	7	33	60	1	1.5	Ilmenite subhedral, magnetite anhedral. Magnetite penetrates ilmenite. Gangue occurs in rounded anhedra.	165′	9	Fine-grained rich ore 9b[1]
15–20	tr	55	45	1.5	1.5	Ilmenite subhedral, magnetite anhedral. Magnetite embays ilmenite in the usual manner. Veinlet of pyrite.	28′	10	Rich ore 10c

10	5	40	55	1.5	1.5	Ilmenite and magnetite grains greatly elongated into a foliated structure. Boundaries of grains very ragged.	5′	11	Rich ore 11b
10	15	40	45	1.5	2	Ilmenite subhedral, magnetite anhedral. Ilmenite embayed by magnetite. Gangue as anhedral masses in ore.	64′	11	Rich ore 111
15–20	10	60	30	1.5	2	Ilmenite subhedral, magnetite anhedral. Magnetite embays ilmenite as usual. Gangue as scattered masses.	76′	12	Rich ore 12e
10–15	16	42	42	1.5	2	Ilmenite subhedral, magnetite anhedral. Ilmenite only slightly corroded by magnetite. Gangue minerals irregular.	140′	13	Rich ore 13w
25	20	25	55	2	2.5	Ilmenite and magnetite subhedral. Intergrowths of magnetite in ilmenite. Magnetite embays ilmenite. Gangue silicates irregular.	36′	14	Rich ore 14c
7	10	60	30	1.75	2	Ilmenite and magnetite subhedral. Magnetite corrodes ilmenite. Just a few anhedral grains of gangue.	12′	15	Rich ore 15a
10	5	60	35	1	1.5	Ilmenite subhedral, magnetite anhedral. Magnetite corrodes and penetrates ilmenite. Gangue intricately associated with ore.	64′	16	Rich ore 16e
8	10	70	20	2	2.5	Ilmenite and magnetite subhedral. Magnetite corrodes ilmenite, penetrating it along cracks. Gangue largely late carbonate.	167′	19	Rich ore 19e
15–20	5	55	40	2	3	Ilmenite and magnetite subhedral. Especially along cracks is ilmenite penetrated by magnetite.	141′	22	Rich ore 22n
10	40	25	35	1	1.5	Ilmenite and magnetite anhedral — grains elongated into flow structure in some portions of polished surface.	55′	27	Fine-grained ore Garnet rich 27c
7–10	5	50	45	1	1	Ilmenite subhedral, magnetite anhedral. Ilmenite grains rounded and embayed by magnetite.	59′ 6″	30	Rich ore 301

TABLE 1—(*concluded*)

Table data from polished surfaces of ore

% ILMENITE INTER-GROWTHS IN MAGNETITE	RELATIVE AMOUNT IN PER CENT			GRAIN SIZE		IMPORTANT STRUCTURAL AND TEXTURAL RELATIONS	DEPTH	HOLE	SPECIMEN
	Gangue	Magnetite	Ilmenite	Magnetite	Ilmenite				
8–10	5	55	40	1.5	1.5	Ilmenite subhedral, magnetite anhedral. Ilmenite embayed by magnetite. Few anhedral grains of gangue silicates.	86′	31	Rich ore 31m
10	2	60	38	2	2.5	Magnetite and ilmenite subhedral. Ilmenite penetrated by magnetite, especially along cracks.	162′	31	Rich ore 31a[1]
....	40	20	40	1	1	Ilmenite and magnetite anhedral. Grains arranged around an inclusion of gangue like wake around a moving boat.	114′	32	Lean ore 32h
15–20	10	60	30	1.5	2.5	Ilmenite and magnetite anhedral. Ore minerals and gangue grains somewhat elongated into flow structure.	215′	34	Rich ore 34y
7–10	1	65	34	2.5	2	Ilmenite and magnetite subhedral. Ilmenite very strongly corroded by magnetite.	201′	35	Rich ore 35t
15	5	65	30	1.5	2.5	Ilmenite subhedral, magnetite anhedral. Ilmenite embayed by magnetite.	271′	35	Rich ore 35b[1]
7–10	10	40	50	1.5	2.5	Ilmenite subhedral, magnetite anhedral. Quite intricate embayment of ilmenite by magnetite.	181′	37	Rich ore 37p[1]
5	15	60	25	1.5	2	Ilmenite and magnetite subhedral. Corrosion of ilmenite by magnetite not intense. Gangue silicates scattered.	500′	37	Rich ore 37f[3]

10–15	tr	75	25	2.5	3	Ilmenite and magnetite subhedral. Ilmenite grains penetrated along cracks by magnetite.	133′	38	Rich ore 38k
5–10	40	35	25	1.5	2	Ilmenite and magnetite anhedral. Corrosion of ilmenite by magnetite not strong. Feldspar remnants with reaction rims.	102′	42	Ore with anorthosite 42h
8	10	40	50	1	2	Ilmenite subhedral, magnetite anhedral. Ilmenite-magnetite relations are mutual. Gangue as anhedra.	62′	46	Rich ore 46b
15	tr	40	60	2	2.5	Ilmenite and magnetite are anhedral, being elongated into flow structure.	42′	50	Rich ore 50n
5–7	15	35	50	1	1.5	Ilmenite subhedral, magnetite anhedral. Corrosion of ilmenite by magnetite especially strong here.	76′	51	Rich ore 51o
....	10	35	55	1.5	2	Ilmenite and magnetite anhedral. Magnetite replaces ilmenite in a very irregular manner. Elongated grains.	51′	52	Fine-grained Rich ore 52p
15–20	5	55	40	2	2.5	Ilmenite and magnetite anhedral. Magnetite embays ilmenite especially along cracks.	11′	53	Rich ore 53a
3–5	20	50	30	2	2.5	Ilmenite and magnetite subhedral. Ilmenite penetrated by magnetite esp. along cracks. Gangue irregularly distributed.	114′	54	Rich ore $54b^1$
10–15	2.5 (pyrite)	40	35	3	3.5	Ilmenite and magnetite subhedral. Ilmenite embayed by magnetite. Pyrite vein 2–7 mm wide cuts ore minerals.	186′	54	Rich ore with pyrite stringer $54r^1$
4–5	15	30	55	1	2	Ilmenite and magnetite anhedral; grains oriented and elongated parallel the flow structure. Gangue as many anhedra.	54′	63	Lean ore 63f
....	10	40	50	2	3.5	Ilmenite subhedral, magnetite anhedral. Magnetite corrodes ilmenite along cracks and boundaries.	55′	47	Rich ore 66i
7–10	25	40	35	1.5	2	Ilmenite anhedral — as is magnetite. Gangue silicates scattered through ore, giving ore mineral anhedral shape.	?	?	Lean ore ?

Grüner (1929) after a study of the space lattices of minerals which commonly form intergrowths concluded that intergrowth occurs only on those crystallographic planes in which the atomic arrangement and spacing are almost alike. He found every third and seventh (111) structure plane of magnetite, and every third plane parallel to the base (0001) of ilmenite consist of oxygen ions, and that the spacing of atoms in the two structures is almost identical. He suggests that the orientation of (0001) intergrowth plates of ilmenite parallel to (111) in magnetite, as suggested by Ramdohr (1926, p. 346), is made possible through a sharing of one oxygen plane by both crystals. Faessler and Schwartz (1941, p. 728) have written the following about the formation of *en echelon* intergrowths:

As the temperature fell and ilmenite began to ex-solve, it took up positions along planes that had been subject to extensive, closely spaced slipping or translation. Crystallographic planes at an angle to the plane of translation would be offset and thus perhaps account for the *en echelon* arrangement of the ilmenite inclusions.

Singewald (1913*a*, p. 213–14) analyzed particles of magnetite grains which showed no intergrowths of ilmenite and found them to have a titanium content of 6.6 per cent. He concluded that magnetite could contain titanium in solid solution. Warren (1918, p. 441) also pointed out that magnetites low in titanium probably contain the ilmenite molecule or titanium dioxide in solid solution. The magnetite of the Sanford ores undoubtedly contains a small percentage of titanium in homogeneous mixture, in addition to the intergrowths of ilmenite.

Ilmenite inclusions in magnetite. Inclusions of ilmenite in magnetite are common. These are characterized by ragged borders which suggest that ilmenite has been replaced by magnetite. Relics of ilmenite in magnetite (see figure 37) are found occasionally and remnants of ilmenite grains similar to those in figure 41, are very common.

Vanadium in magnetite. Occurrences of vanadium in titaniferous iron ores have been known for many years, but the manner in which it occurs is not definitely known. Schneiderhöhn and Ramdohr (1931, p. 584) say that vanadium is contained in magnetic magnetite in isomorphous mixture like spinel. An average of slightly less than 0.50 per cent V_2O_5 has been reported in analyses of Sanford ores by the National Lead Company. Most of this is recovered with the magnetite concentrates, but ilmenite concentrates carry only a trace. The U. S. Geological Survey has undertaken a study of the vanadium content.

The study of polished surfaces of ore from the Sanford area did not shed any light on the mode of occurrence of the vanadium. No vanadium minerals were found. The element is intimately associated with magnetite, perhaps as the mineral coulsonite.

Dunn (1937) recognized a vanadiferous maghemite in titaniferous iron ores from India which he named coulsonite and to which he assigned the tentative formula $FeO.(Fe, V)_2O_3$. He states that less than 20 per cent V_2O_3 is present in this mineral. Dunn describes the mineral as follows:

> Coulsonite could only be determined microscopically; it occurs in patches in the magnetite, and contains the usual ilmenite intergrowth . . . Its properties are largely similar to normal magnetite and to maghemite. It is magnetic. Compared with normal magnetite its power of reflection is slightly higher, about 23. Colour: bluish grey, but with high power and oil immersion there is, in some specimens, a noticeable but rapid gradation from normal brownish magnetite to the blue-grey of the vanadium-bearing variety . . . Isotropic . . . Negative to all usual reagents . . . Gives a definite test for vanadium.

Alderman (1925), in a study of titaniferous ores from South Australia found the vanadium content to increase with an increase in titanium. The ratio of vanadium pentoxide to titanium dioxide in these ores is 1:60. Pope (1899) reported a ratio of 1:28 for ores in Ontario.

Spinel intergrowths in magnetite. Lamellar intergrowths of spinel parallel to the cube direction in magnetite may occur (see figure 32) but they are far less abundant than ilmenite intergrowths. Grüner (1929, p. 230) points out that every second plane of the two minerals which are isomorphous is an O plane. This plane serves as the contact plane of the intergrowth.

Anhedra of spinel in magnetite commonly exist in addition to the regularly arranged intergrowths. These anhedra commonly occur along the boundaries of ilmenite and magnetite (see figures 30, 31 and 46). They form reentrants in ilmenite but form smooth boundaries with magnetite. Some of the ore in gabbro has abundant spinel anhedra associated with the magnetite. Spinel probably formed during the crystallization period of the magnetite.

Ilmenite. Ilmenite is generally corroded and embayed by magnetite which is anhedral to it (see figures 38, 39, 40, 41, 42, 43 and 44). Osborne (1928*b*, p. 908) says ilmenite is later than magnetite, but the abundant corrosion of ilmenite by magnetite appears to refute this statement.

Gangue silicates. Magnetite is anhedral to the gangue silicates of the gabbro and of the reaction rims which occur between ore and anorthosite. Commonly the magnetite completely incloses grains of the gangue silicates.

Gangue sulphides. Gangue sulphides, pyrrhotite and pyrite, are present in minor amounts. Small rounded anhedra of pyrrhotite occur as inclusion in magnetite but are most frequently associated with minerals of the reaction zone between ore and anorthosite. Pyrite occurs as late veinlets cutting ore minerals. Only a few of these veinlets, none more than one-half inch wide, were found in the drill core from the Sanford Hill ore body. Pyrite probably was the last mineral of the magmatic sequence to consolidate.

Ilmenite

Ilmenite contains no intergrowth but does include small anhedra of pyrrhotite and gangue silicates. It is anhedral to the gangue silicates but is generally subhedral to euhedral to magnetite. The intricate manner in which ilmenite is corroded and embayed by magnetite is conclusive evidence that the ilmenite is earlier than magnetite. Spinel, which commonly forms at boundaries of ilmenite and magnetite forms reentrants in ilmenite; it is probably later than ilmenite. Ilmenite follows the gangue silicates in the paragenetic sequence.

Gangue Minerals

Gangue of Ore in Gabbro. Gangue minerals of ore in gabbro are the minerals of the rock and have been described. Ore incloses these minerals and is anhedral to them (see figure 47).

Gangue of Ore in Anorthosite. Gangue of ore in anorthosite consists of plagioclase crystals or masses of anorthosite surrounded by a zone of reaction minerals, which varies in width from a fraction of an inch to several inches. Individual plagioclase phenocrysts in the ore are usually dark green, due to dustlike and rodlike inclusions of magnetite and spinel which are commonly so abundant that the plagioclase is almost opaque in thin section (see figure 24).

Reaction minerals always occur between ore and anorthosite. The minerals of the reaction zone are the same as those developed in the gabbro and anorthosite through normal crystallization and these minerals are arranged in bands between ore and anorthosite (see figures 23 and 24). Figure 19 is a schematic diagram of the reaction zone and shows the position of various minerals between ore and anorthosite. Plagioclase of anorthosite is usually filled with

inclusions along contacts with ore. Enveloping the inclusion-filled plagioclase is a narrow fringe of clear plagioclase with minute spinel anhedra scattered through it. Beyond this is a band of garnet which commonly forms myrmekite-like intergrowths with feldspar. The next band is made up principally of augite with some green hornblende. The band nearest the ore contains the same femic minerals as ore-bearing gabbro: hypersthene, diallage, brown hornblende and

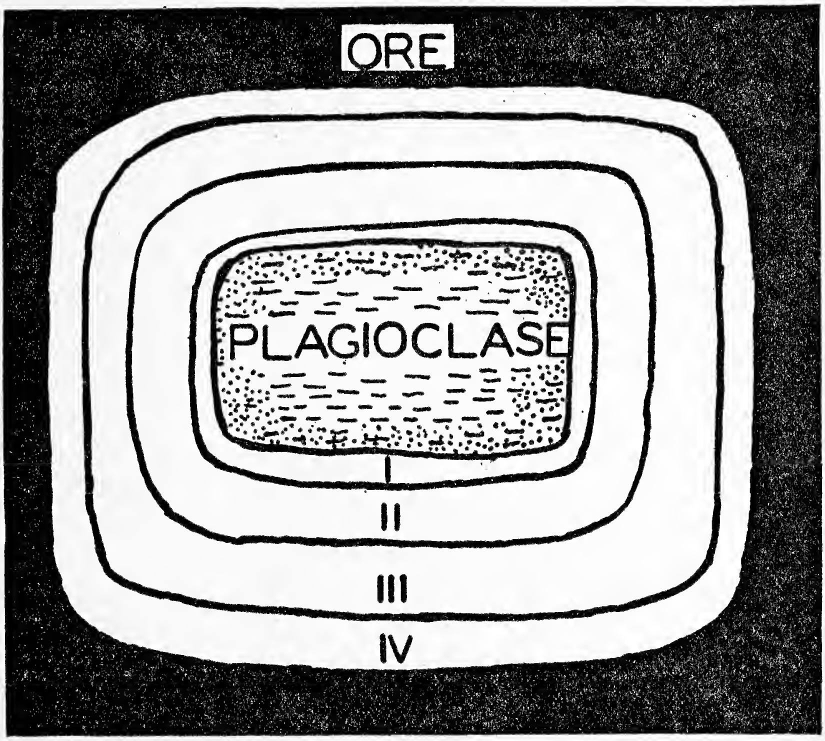

Figure 19 Schematic diagram of a reaction zone between ore and anorthosite. Zone I, clear feldspar and small spinel anhedra; II, garnet; III, augite, with some green hornblende; IV, hypersthene, diallage, brown hornblende and biotite.

biotite. The bands are not sharply defined, and commonly the reaction zone lacks several of the minerals. Garnet, in places, makes up almost the entire zone. In other places biotite or pyroxene predominate. Small anhedral grains of pyrrhotite are commonly included in the pyroxenes and hornblende.

Generally speaking, the minerals nearest the plagioclase formed first and those nearest the ore, last. Paragenetic relations are found to vary with the width of the zone and the relative abundance of the

minerals making up the zone. Crystallization was almost simultaneous where the reaction zone is narrow, but normally the crystallization periods of the minerals overlapped.

The zones originated through deuteric reaction between the ore-bearing residuum and the already consolidated anorthosite. The plagioclase probably supplied silica, calcium and alumina, and the ore residuum iron, magnesia and water, for the reaction minerals. It is possible that much anorthosite was removed by the liquid ore residuum through deuteric action prior to the formation of the reaction zones.

ORIGIN

Ore bodies of magmatic origin were recognized by a few investigators during the 19th century, but the concept of accumulation of pyrogenetic minerals to form ore bodies became firmly established through a classic paper by Vogt (1893). He listed the distinguishing characteristics of magmatic segregation deposits as: (1) The ore minerals are common accessory opaque minerals of igneous rocks. (2) The inclosing rock is always igneous, usually basic in composition. (3) The gangue minerals are the same as the constituent minerals of the rock. (4) The ore body frequently grades into the igneous rock by decrease in the amount of ore minerals and increase in amount of silicates.

Vogt outlined three methods by which he believed magmatic segregation could take place. These were: (1) Ore minerals could crystallize early and aggregate in the molten magma. (2) Ore minerals could crystallize early, aggregate and be resorbed to form a magma of different composition, and (3) ore minerals could concentrate through diffusion in the liquid state. Beyschlag, Vogt and Krusch (1914, p. 243) concluded that the ore minerals crystallized early, aggregated, were resorbed and intruded as a magma to form lodes or streaks. Lindgren (1913, p. 749) pointed out that magnetite and ilmenite, as a rule, crystallized after the silicates in titaniferous deposits which differentiated *in situ* in gabbro and norite bodies. On page 740 of the same edition he said: "In the formation of titanic iron ores of the Adirondacks the ilmenite probably crystallized first and settled to the bottom." In later editions he states that the ore minerals crystallize after the silicates in titaniferous iron ore deposits. There was evidently some question in Lindgren's mind as to the correct paragenetic relation of these minerals, when he compiled the earlier volume. Broderick (1917, p. 691–93) concluded that titaniferous magnetite in the Duluth gabbro crystallized after the rock forming silicates.

Tolman and Rogers (1916) conclusively proved that magmatic sulphide replaced silicates after the consolidation of the igneous rock and emphasized the role of mineralizers in the process. Similar conditions exist between oxidic ores and primary silicates, as pointed out by Singewald (1917). Newhouse (1936) through an exhaustive study has done much to clarify the confusion concerning the position of the opaque oxides in the crystallization sequence of igneous rocks. He writes:

> The bulk of opaque oxides are very early in granite. At the other end of the rock series, many gabbros, diabases and basalts contain opaque oxides, which, in part, finished crystallizing later than the bulk of the ferromagnesian and feldspar crystals.

Bateman (1942, p. 8–9) recently proposed a classification of magmatic mineral deposits. His classification is in brief:

- I Early-magmatic
  - *A* Dissemination
  - *B* Segregation
  - *C* Injection
- II Late-magmatic
  - *A* Residual liquid segregation
  - *B* Residual liquid injection
  - *C* Immiscible liquid segregation
  - *D* Immiscible liquid injection

Early magmatic deposits are those formed during the main stages of magma crystallization and embrace those that have been termed orthomagmatic and orthotectic. Late-magmatic deposits are those formed toward the close of the magmatic period from pyrogenetic minerals. They are consolidated residual magma. Bateman classed the Adirondack titaniferous ores as residual liquid injections, on the basis of Osborne's study.

Oxide ores comparable to Beyschlag, Vogt and Krusch's injected sulphide deposits, are, according to Singewald (1933), the schlieren-like injections and dikes of ores that represent liquid ore differentiates squeezed into new positions in either still molten or already consolidated portions of the magma.

Osborne (1928*b*, p. 730–32) proposed the term "magmatic injection" for intrusive deposits of pyrogenetic minerals. He suggested this term to describe some titaniferous magnetite ore bodies which can not be termed magmatic segregations because they are not concentrations of the early crystallizing minerals in place. Osborne would restrict magmatic segregation to describe deposits in which there is a concentration of earlier minerals along margins.

Osborne proposed filter pressing of anorthosite to yield a magma containing pyroxene, plagioclase and iron ore. This rest magma was then injected into anorthosite to form ore bodies and gabbro dikes. The writer agrees with Osborne's fundamental concepts of genesis of the Sanford ore, but would suggest some modifications in view of additional structural and petrographic data.

Conformable lenses of ore in gabbro were not recognized by Osborne, nor were rapid gradations from anorthosite to gabbro and ore, such as occur along Calamity brook. Lenses of ore in gabbro are associated with all of the ore bodies in the Lake Sanford area. Petrographic and structural evidence strongly support the conclusion that the ore concentrated as a late liquid residuum in the gabbro. This ore-rich residuum formed lenses which grade into the inclosing gabbro. These lenses are magmatic segregations. Foliation of ore minerals along the boundary of some of these lenses indicates that the ore residuum flowed through the lenses as crystallization of ore minerals was in progress.

The ore-bearing gabbro grades into anorthosite and gabbroic anorthosite, in the Sanford Hill, Ore Mountain and Calamity-Mill Pond ore bodies. Where ore moving along encountered already consolidated anorthosite it penetrated and replaced this rock to form discordant bodies. Osborne would call these magmatic injections. Localization of ore of this type forms large masses in the Sanford Hill and Ore Mountain ore bodies. That the ore-residuum was tenuous is indicated by its ability to penetrate anorthosite out from the contact in an irregular manner and also as well-defined stringers which occur along joint planes. Singewald (1917, p. 736) suggested such evidence was indicative of participation of mineralizers in magmatic ore deposition. The abundance of pyroxene compared to hornblende and biotite in the reaction zone between anorthosite and ore indicates that volatile constituents entered only to a minor extent into the formation of the reaction minerals.

The writer concludes that the Lake Sanford titaniferous iron ores are of two types, magmatic segregations in gabbro and magmatic injections in anorthosite. The two types are genetically related. The ore residuum of gabbro supplied the ore constituents which form large masses in anorthosite. The magmatic segregations in gabbro would conform to Bateman's type II*A*, residual liquid segregation, and ore in anorthosite to II*B*, residual liquid injection.

ECONOMIC CONSIDERATIONS

RESERVES[3]

The MacIntyre Iron Company estimated the reserves of ore in the three larger ore bodies following a magnetic survey and a diamond drilling program during the years 1906–12. The estimates are of ore which ran more than 45 per cent iron. This ore was considered rich. The National Lead Company through its development program determined the ratio of ilmenite concentrates to ore in the Sanford Hill ore body as 0.1845:1. The tonnage of recoverable ilmenite concentrates in the ore bodies can be estimated by applying this ratio to the ore reserve estimates of the MacIntyre Company.

TABLE 2

Estimated reserves of titaniferous magnetite in the Lake Sanford area

ORE BODY	RICH ORE	ILMENITE CONCENTRATE
Sanford Hill	24,263,772 tons	4,476,523 tons
Ore Mountain	17,415,914 tons	3,213,235 tons
Calamity-Mill Pond	9,101,872 tons	1,679,295 tons
Total	50,781,558 tons	9,369,053 tons

The National Lead Company's estimate of reserves of ore in the Sanford Hill body is considerably more conservative than that of the MacIntyre Iron Company. It is possible that the other estimates are likewise too high. The Cheney Pond ore body is much too small to merit economic consideration.

MINING AND MILLING

Oliver (1942) summarizes the proposed operation plan for the MacIntyre development:

The program of operation calls for the mining of 5500 gross tons of ore daily from which the mill being erected will produce 800 tons of ilmenite of about 48 per cent TiO_2 content. In addition, as a by-product there will be stockpiled approximately 1800 tons per day of magnetite concentrates, containing about 89 per cent Fe_3O_4, 10 per cent TiO_2 and 1 per cent Si. The crude ore contains about 16 per cent TiO_2, based on assays of numerous diamond drillings. Since there is a huge outcrop measuring 550 by 1700 feet on the western slope of Sanford hill, the mine will be of the open type, utilizing

[3] Data made available through the courtesy of the MacIntyre Iron Company and the National Lead Company, Titanium Division.

churn drills to break the deposits, and electrically operated shovels and dippers to load the broken ore.

The crushing plant will have a jaw crusher, a standard cone crusher and a short-head crusher, with attendant screens and conveyors. In the wet mill will be four rod mills, 12 Crockett wet belt separators for separating the magnetite, 96 wet concentration tables for separation of the ilmenite and units for dewatering the concentrate. In addition there will be a dry mill with a battery of steam coil driers and 21 Wetherill dry magnetic separators.

From the shipping bins the concentrates will be transported to the railhead at North Creek, 32 miles away, by motor trucks over a new eight and one quarter mile road built out to the State highway, 28N, at Tahawus P. O.

USES OF ORE MINERALS[4]

Ilmenite

The bulk of ilmenite consumed in the United States is used for production of titanium pigments, but the increasing use of titanium alloys is requiring more ilmenite each year. Titanium pigment possesses high opacity and hiding power desirable in paints, decorative coatings, paper, rubber, cosmetics, rayon and many other products. The pigment has greater covering power than other white pigments, is nontoxic, and is immune to discoloration by exposure to sulphur-bearing gases.

Magnetite

TiO_2, which averages 10 per cent in the magnetite concentrates, is considered quite objectionable by blast furnace operators. Present shortages of high grade iron ore and scrap iron, however, may lead to use of these ores in mixtures with nontitaniferous ores in blast furnaces in the eastern United States. At the present time no commercial process is in use in the United States for extracting vanadium from vanadiferous magnetite, but very possibly some method of extraction will be the outgrowth of the present shortage of vanadium. If such a process is put into practice the value of the Sanford magnetite concentrate will greatly increase.

[4] Minerals Yearbook, Review of 1940

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GLOSSARY

Exsolution: see unmixing.

Granitoid: normally indicates a phanerite of medium grain, approximately equigranular. Grout, p. 42.

Hypautomorphic-granular: refers to a rock in which some of the crystals show their own crystal boundaries and some do not. Johannsen, 1931, v. 1, p. 37.

Hyperfusible components: substances contained in a magma which have a low melting point, are easily vaporized, and possess high vapor pressures. Brown, 1933, p. 211–15.

Hypidiomorphic: partly bounded by crystal faces, hypautomorphic, subhedral.

Linear flow structure: orientation of minerals in an igneous rock due to primary igneous flow. The strike of lineation is projected in the horizontal plane when it is recorded.

Peritectic reactions: reactions between solid phases and still unconsolidated portions of the melt. Johannsen, v. 1, p. 186.

Planar flow structure: minerals oriented into parallel planes by primary igneous flow.

Protoclastic structure: structure produced by the granulation of minerals of early formation, the granulation being due to differential flow of the partly consolidated magma from which the fractured minerals separated. Holmes.

Synneusis: texture in which individual crystals of some mineral swam together in the magma to form groups or aggregates. Vogt, 1921.

Unmixing: separation out of a component from a solid solution saturated with that component. Exsolution.

Xenolith: fragment of other rock or of an earlier solidified portion of the same mass inclosed in an igneous rock; an inclusion; an enclave. Ries.

Xenomorphic-granular: texture of a rock in which none of the constituents has its own boundary. Johannsen, v. 1, p. 39.

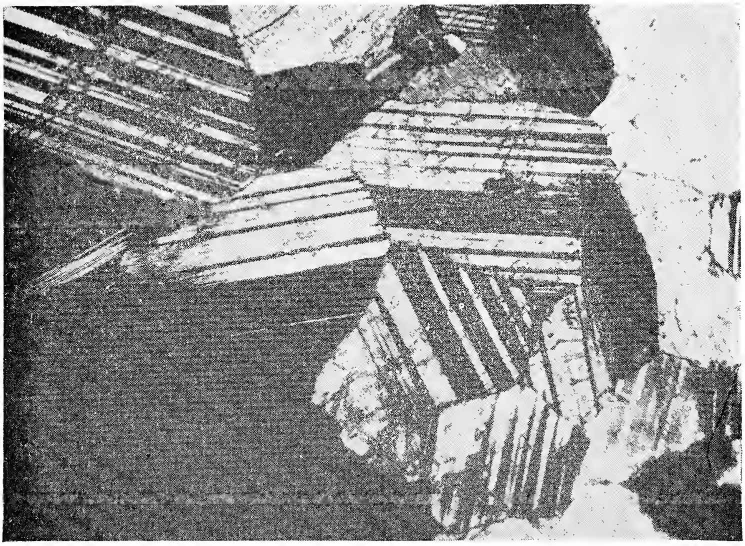

Figure 20 Medium-grained anorthosite with xenomorphic-granular texture. Labradorite crystals have composition of $Ab_{42}An_{58}$. From drill core at Sanford hill. (Crossed nicols). X40.

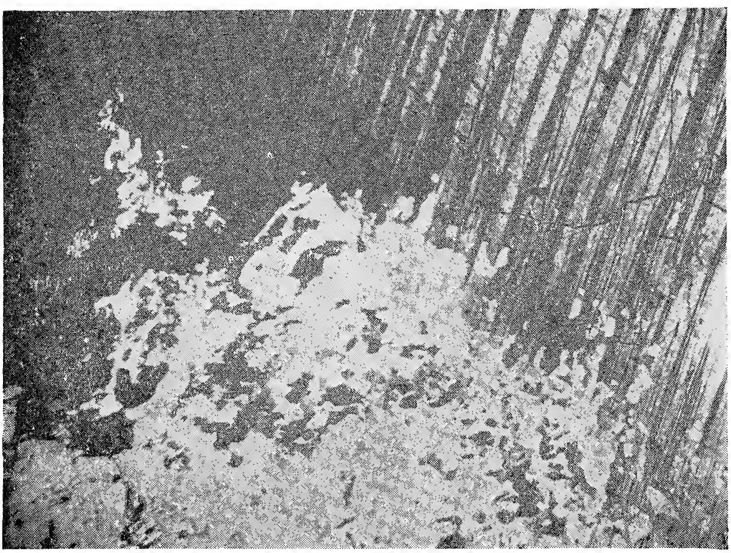

Figure 21 Alteration of plagioclase (twinned crystal) to scapolite (light) in anorthosite from Sanford hill. (Crossed nicols). X40.

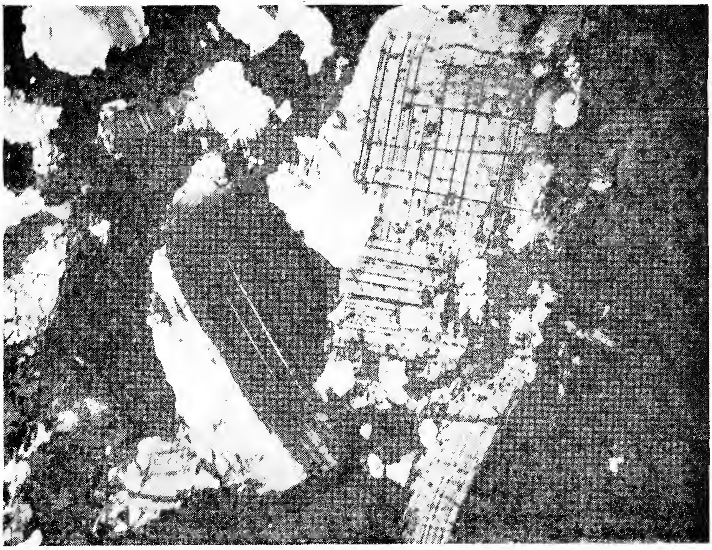

Figure 22 Anorthosite from Hudson River bank just above the "Iron dam." Labradorite crystals show bent albite twins and the edges have been resorbed by the finer-grained plagioclase. Black area to the right of the field is anhedral mass of ore minerals surrounded by a rim of garnet. (Crossed nicols). X40.

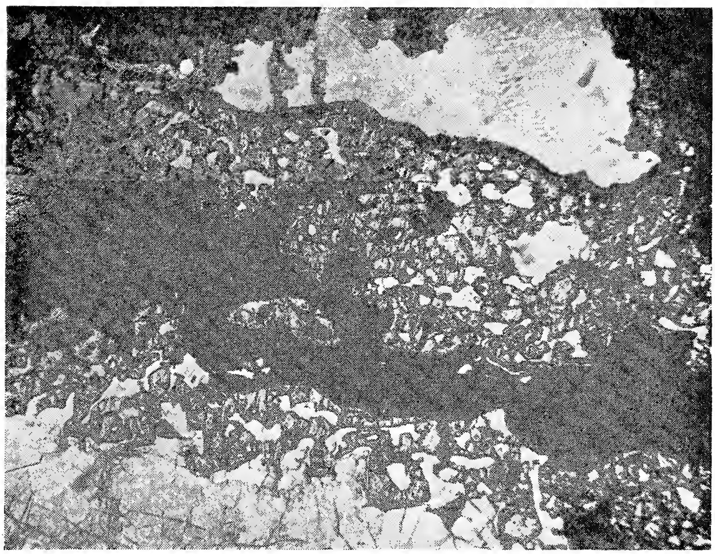

Figure 23 Ore minerals (black) penetrating anorthosite from diamond drill core at Sanford hill. Myrmekite-like intergrowth of garnet (gray, high relief) with plagioclase. (light). Dark gray mineral is hornblende. A chlorite-calcite veinlet cuts across the upper portion of the field. X40.

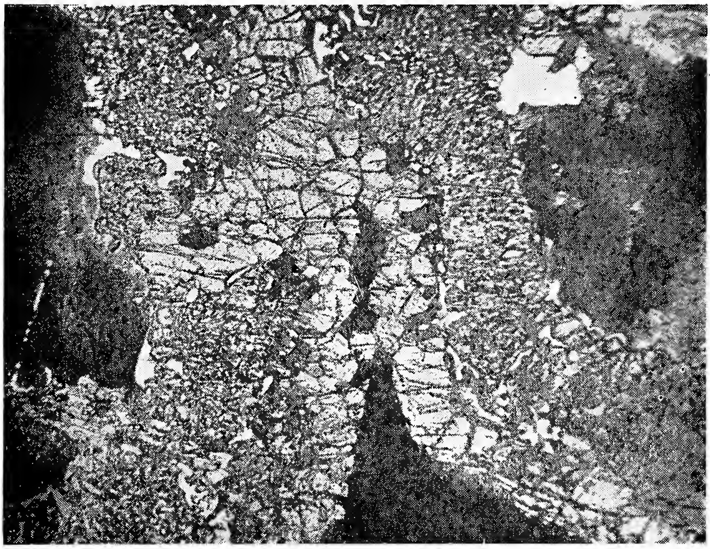

Figure 24 Reaction zone between ore and anorthosite from Sanford hill. Ore (black, lower center), is separated from labradorite (on either side), which in almost black due to dustlike inclusions it contains, by several zones of reaction minerals. A very narrow zone of clear feldspar with minute spinel anhedra occurs between the inclusion-filled plagioclase and a band of vermicular garnet and feldspar. Between this zone and the ore is an augite band. X40.

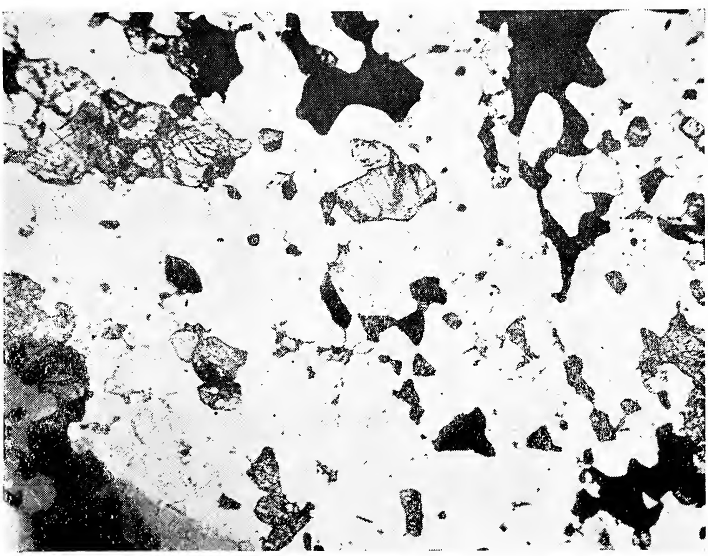

Figure 25 Fine-grained gabbro from diamond drill core at Sanford hill. Minerals are labradorite (light) augite (gray) and ore minerals (dark). Ore minerals have a very irregular anhedral shape. X40.

Figure 26 Gabbro from diamond drill cores at Sanford hill, rich in ore minerals, garnet and augite. X40.

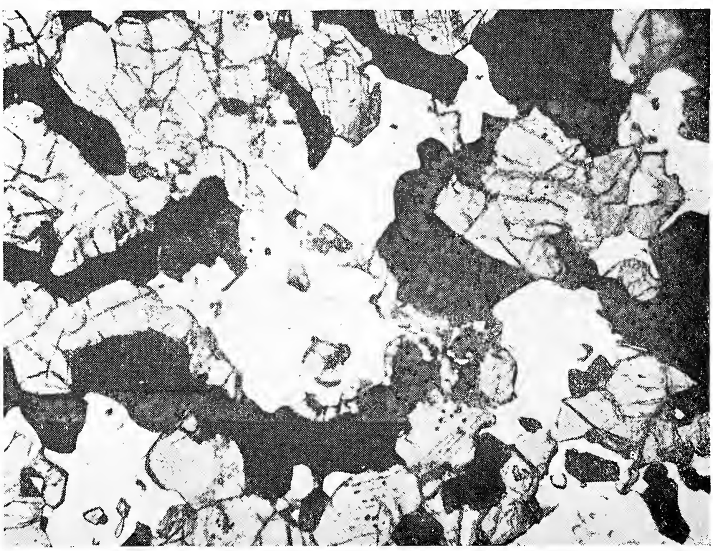

Figure 27 Ore rich gabbro from diamond drill cores at Sanford hill. Accompanying ore minerals are diallage, garnet and labradorite. X40.

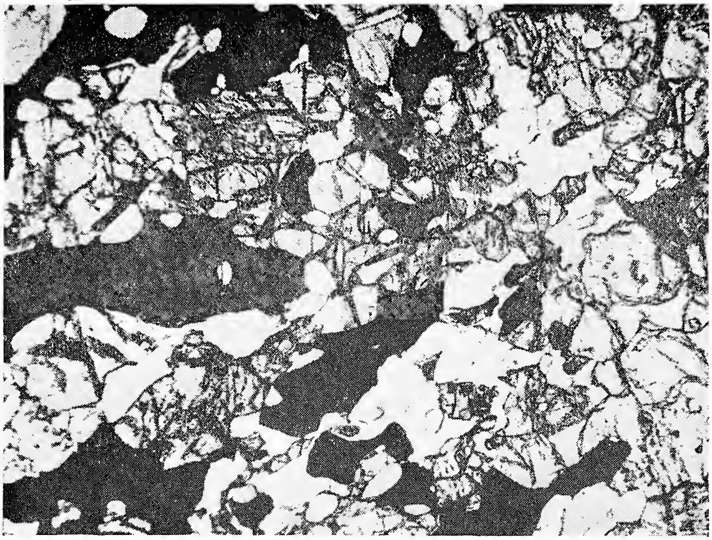

Figure 28 Ore-rich gabbro from Cheney Pond body. Plagioclase, garnet, augite, apatite and ore minerals form this rock X40.

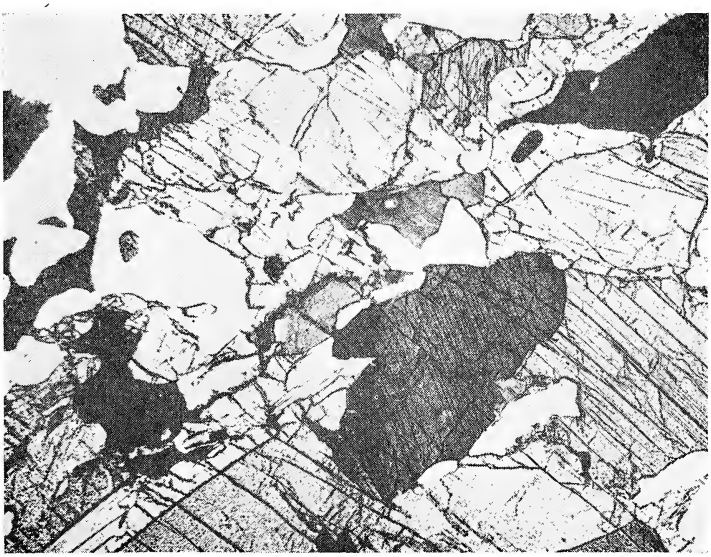

Figure 29 Ore minerals in hornblende-rich gabbro from the diamond drill core at Sanford hill X40.

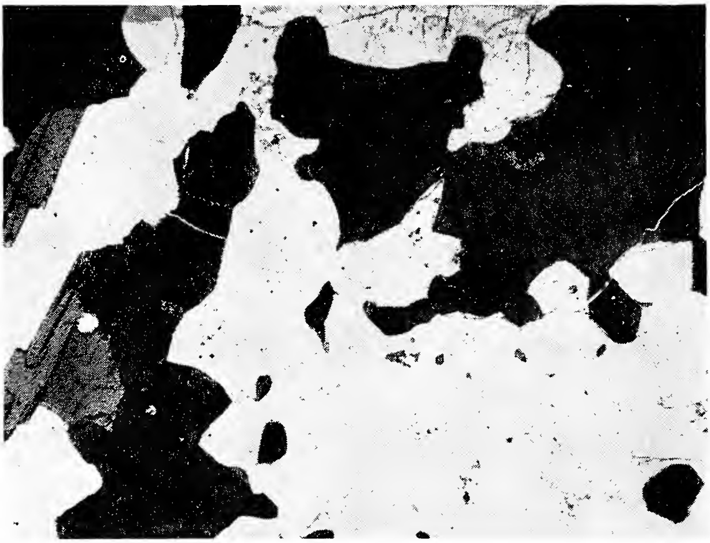

Figure 30 Anhedral ore minerals in ore-rich gabbro from diamond drill core at Sanford hill ×40.

Figure 31 Gabbroic lean ore from diamond drill core at Sanford hill. Narrow cracks (white) in ore (dark) are filled with spinel ×40.

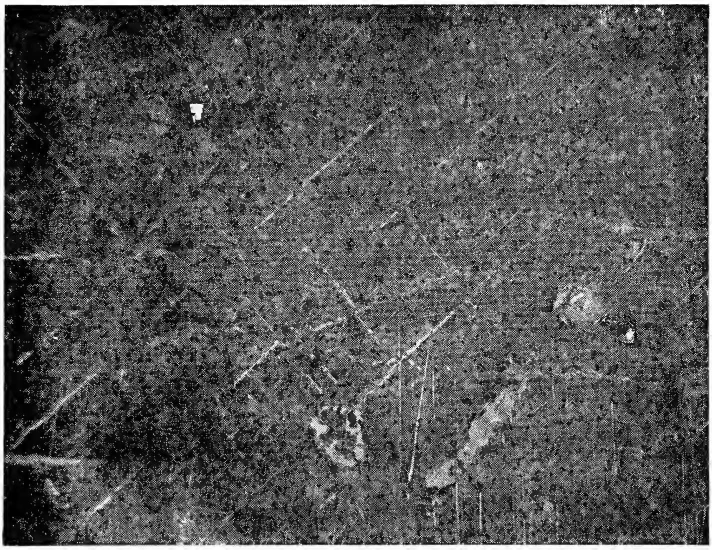

Figure 32 Inclusions of ilmenite and spinel in magnetite (dark). Spinel intergrowths occur as plates along cube directions in magnetite, and as irregular anhedra. The intergrowths of spinel along the cube faces are widely spaced, have rough borders, and may be cut by closely spaced, sharply defined, fine ilmenite lamellae which occur along octahedral planes. Etched with HCl. X100.

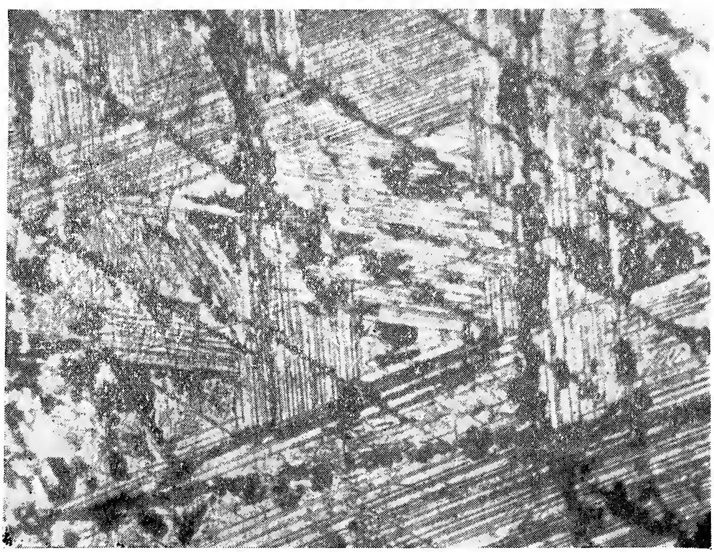

Figure 33 Ilmenite lamellae (dark) occurring along octahedral planes of magnetite. Etched with HF fumes. X100.

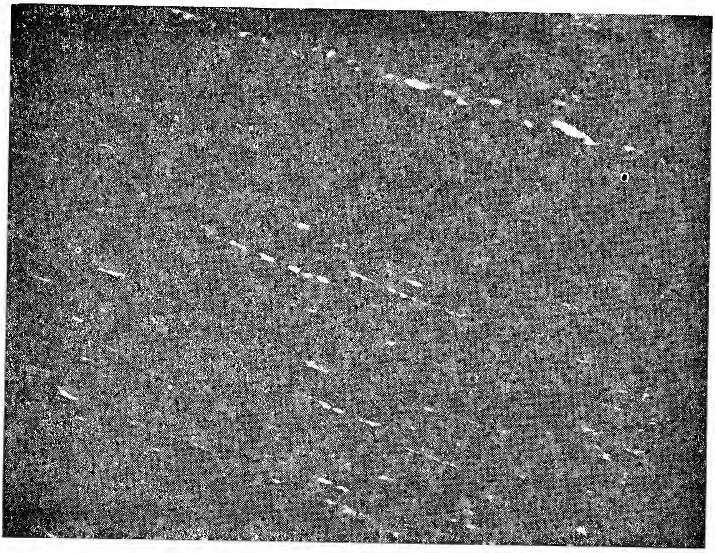

Figure 34 Intergrowths of ilmenite (light) in magnetite (dark) from Ore Mountain body. Irregular intergrowth and minute flecklike intergrowths occur parallel to octahedral planes of magnetite. Etched with HCl. X100.

Figure 35 Intergrowths of ilmenite (light) in magnetite (dark) from Calamity-Mill Pond body. Types of intergrowths are:
1 Regular tabular plates parallel octahedral
2 Flecklike intergrowths parallel octahedral
3 *En echelon* intergrowths parallel octahedral
4 Irregular concentrations along boundary of magnetite grains (runs diagonally across center of photomicrograph). Etched with HCl. X100.

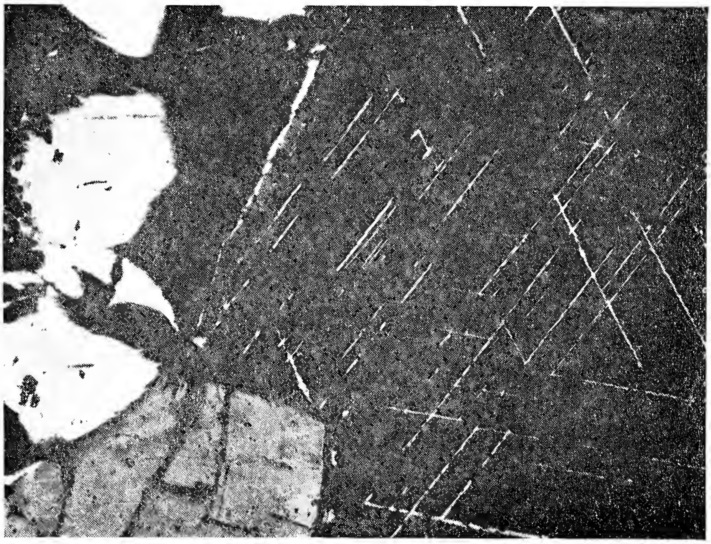

Figure 36 Ilmenite intergrowths (light) occur along octahedral planes of magnetite (dark) and along boundary of magnetite grains. Magnetite corrodes ilmenite grains. Garnet is subhedral against magnetite which penetrates along cracks in the garnet. From diamond drill core at Sanford hill. Etched with HCl. X100.

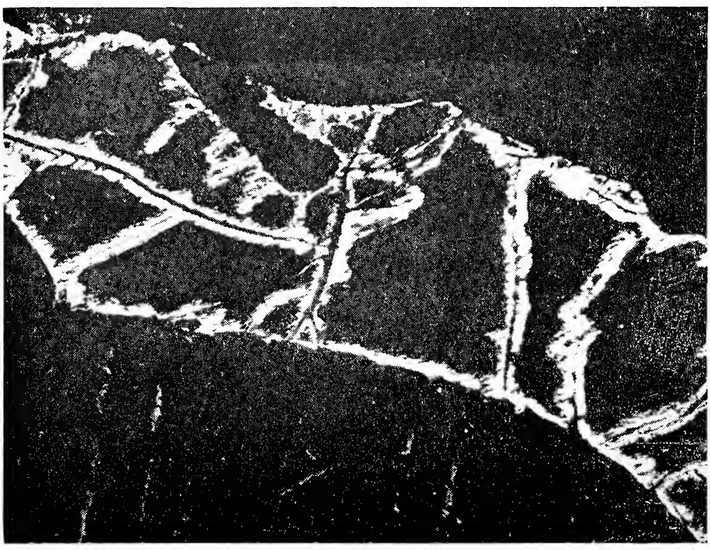

Figure 37 Relic of ilmenite (light) in magnetite (dark) from Cheney Pond body. Etched with HCl. X100.

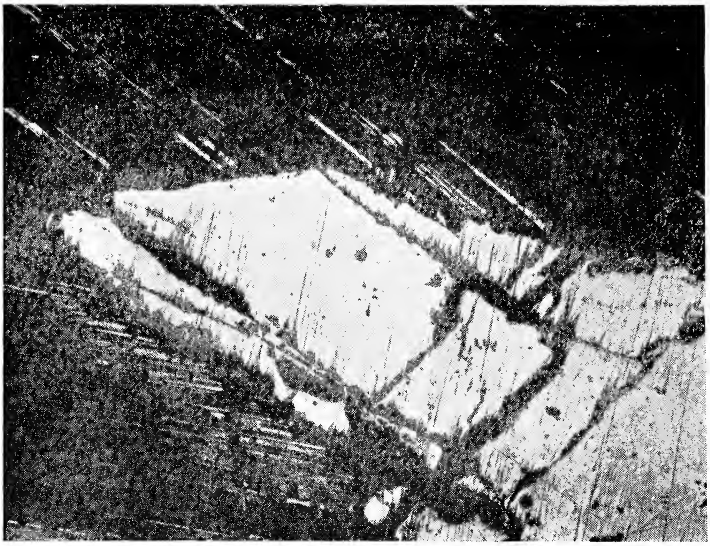

Figure 38 Ilmenite (light) corroded along boundaries by magnetite (dark) which also penetrates along cracks in ilmenite. Ilmenite lamellae in magnetite are more abundant near ilmenite grains. Diamond drill core at Sanford hill. Etched with HCl. X100.

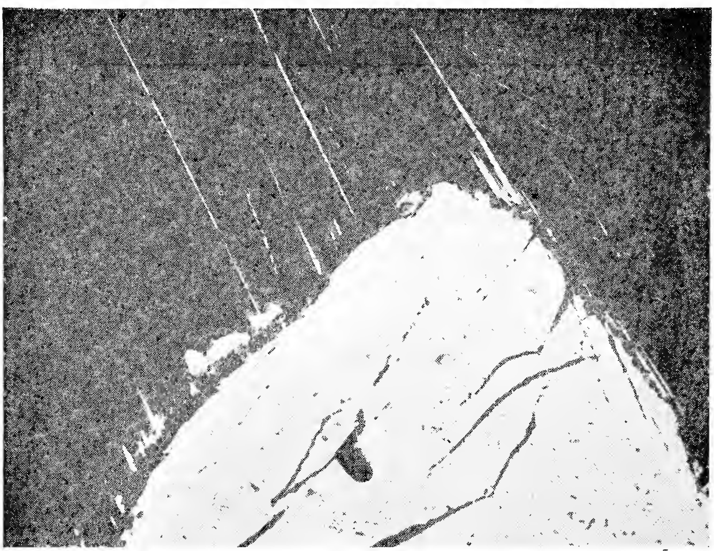

Figure 39 Ilmenite (light) corroded by magnetite (dark). A few ilmenite lamellae in magnetite. Diamond drill core at Sanford hill. Etched with HCl. X100.

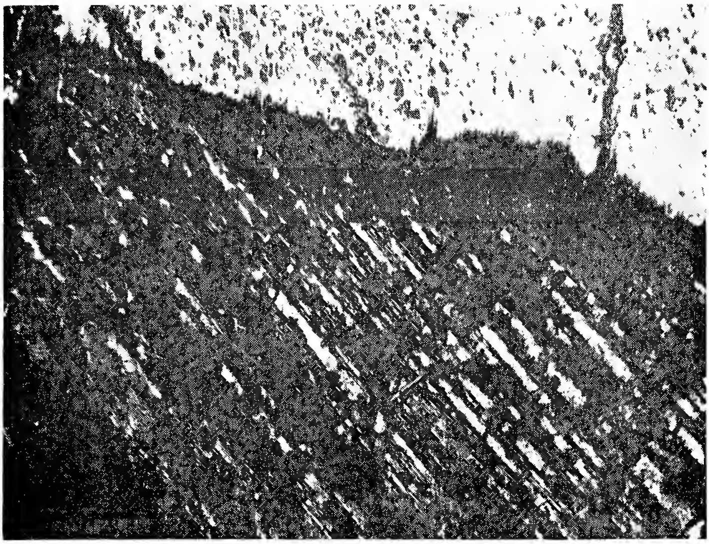

Figure 40 Ilmenite (light) embayed along cracks by magnetite (dark). Irregular intergrowths of ilmenite closely spaced in magnetite. Etched with HCl. X100.

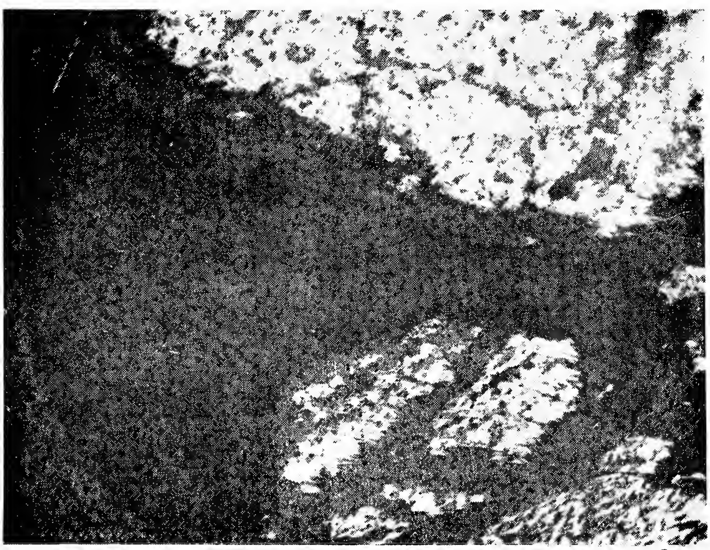

Figure 41 Remnants of ilmenite (light) in magnetite (dark). Etched with HCl. X100.

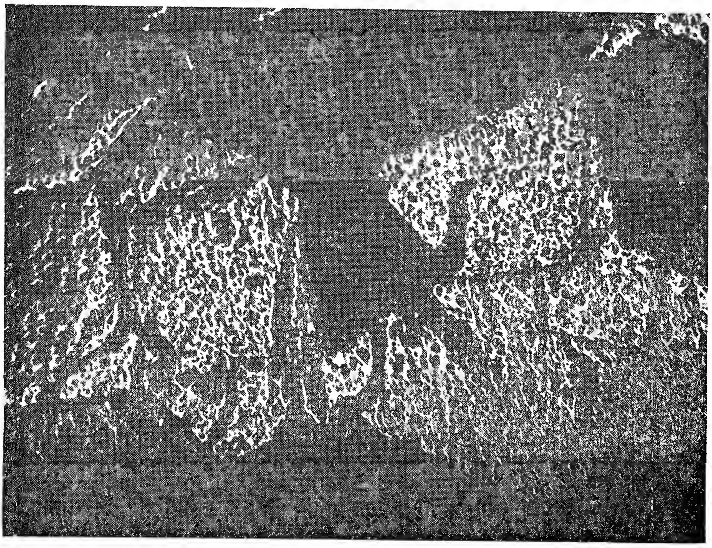

Figure 42 Ilmenite (light) corroded and embayed by magnetite (dark). Diamond drill core at Sanford hill. Etched with HCl. X25.

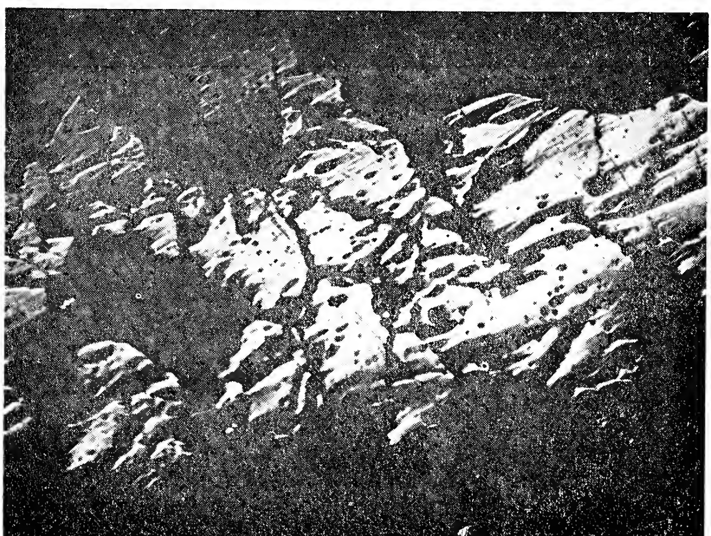

Figure 43 Ilmenite (light) corroded and embayed by magnetite (dark). Diamond drill core at Sanford hill. Etched with HCl. X25.

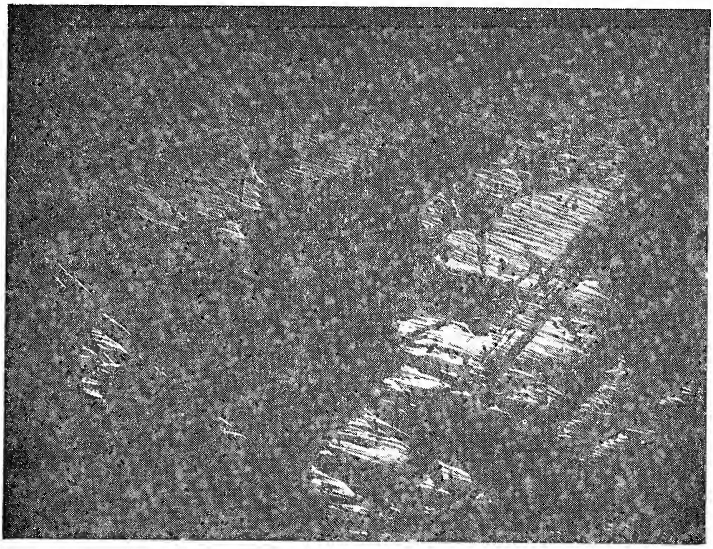

Figure 44 Ilmenite (light) corroded and embayed by magnetite (dark). Diamond drill core at Sanford hill. Etched with HCl. X25.

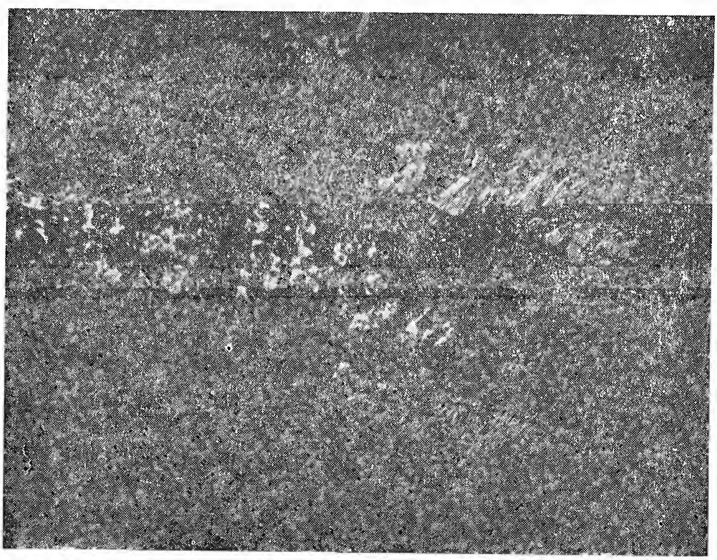

Figure 45 Ilmenite (gray) and magnetite (light) grains elongated to form foliation. Diamond drill core at Sanford hill. X25.

Figure 46 Spinel anhedra (gray) occur between ilmenite (light) and magnetite (dark) grains. Diamond drill core at Sanford hill. Etched with HCl. X100.

Figure 47 Gangue minerals (gray) in magnetite (dark) and ilmenite (light). Garnet crystal euhedral against ore minerals. Diamond drill core at Sanford hill. Etched with HCl. X25

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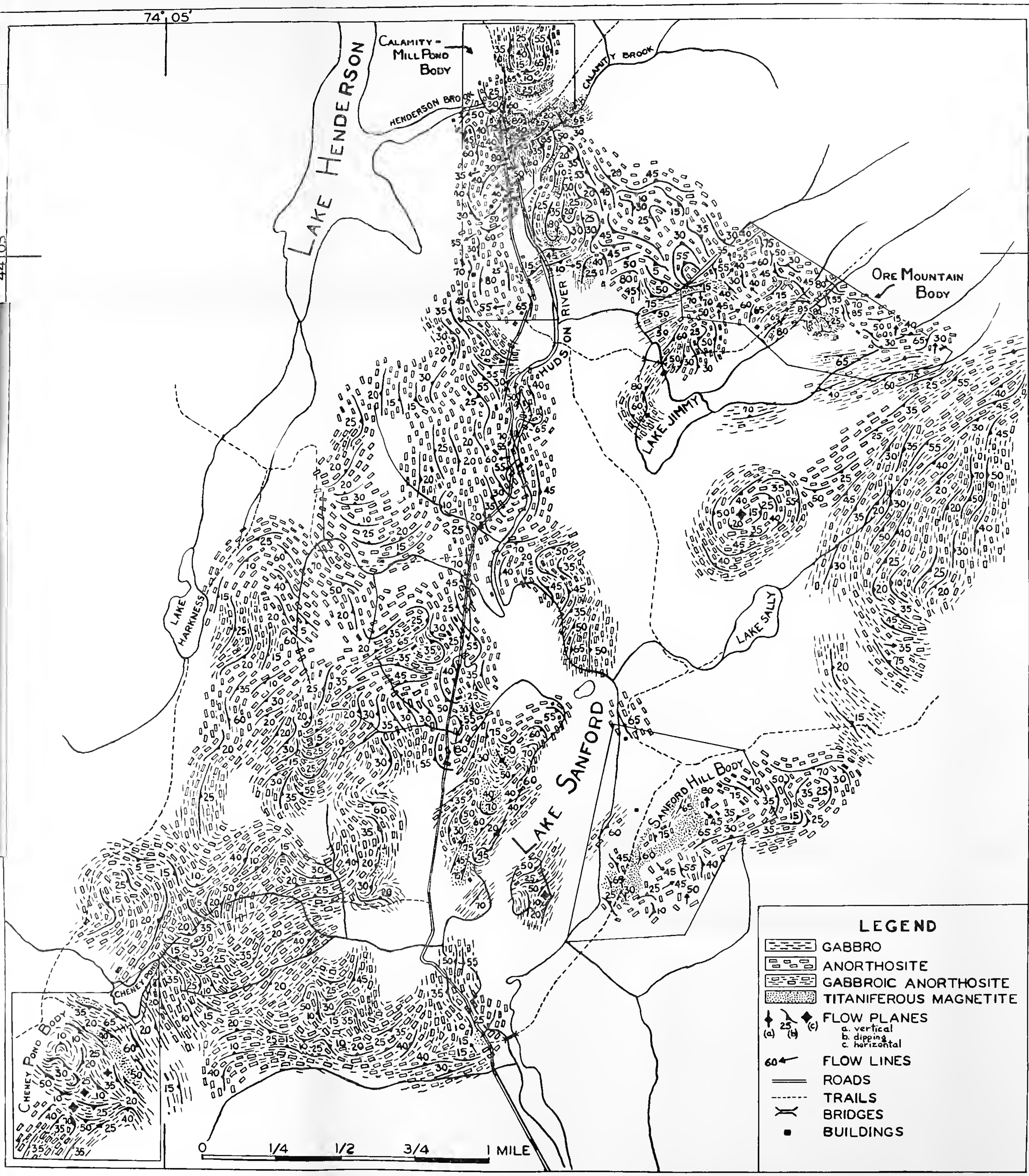

Figure 2 Geologic map of the Lake Sanford area

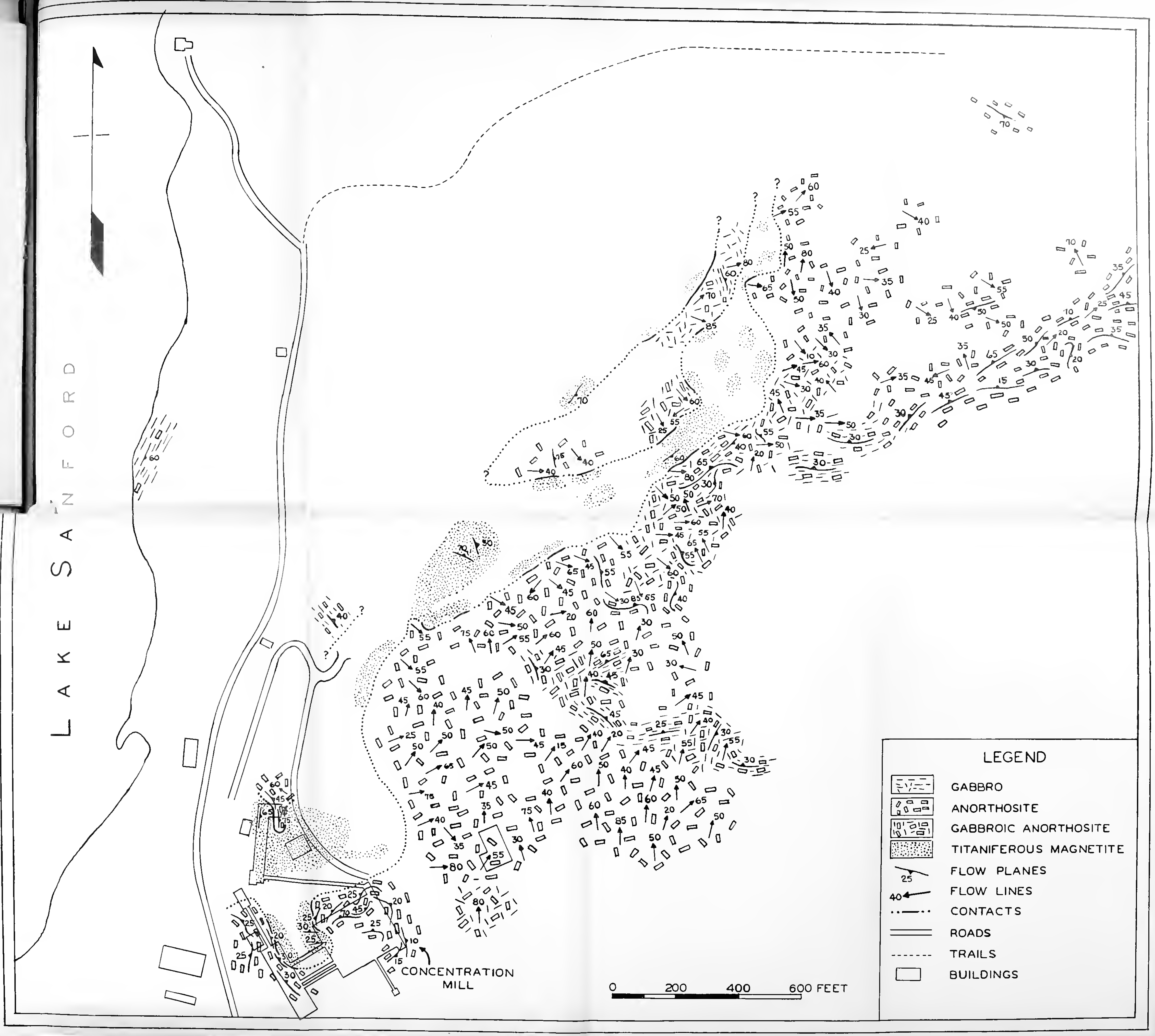

Figure 8. Geologic map of the Sanford Hill ore body.

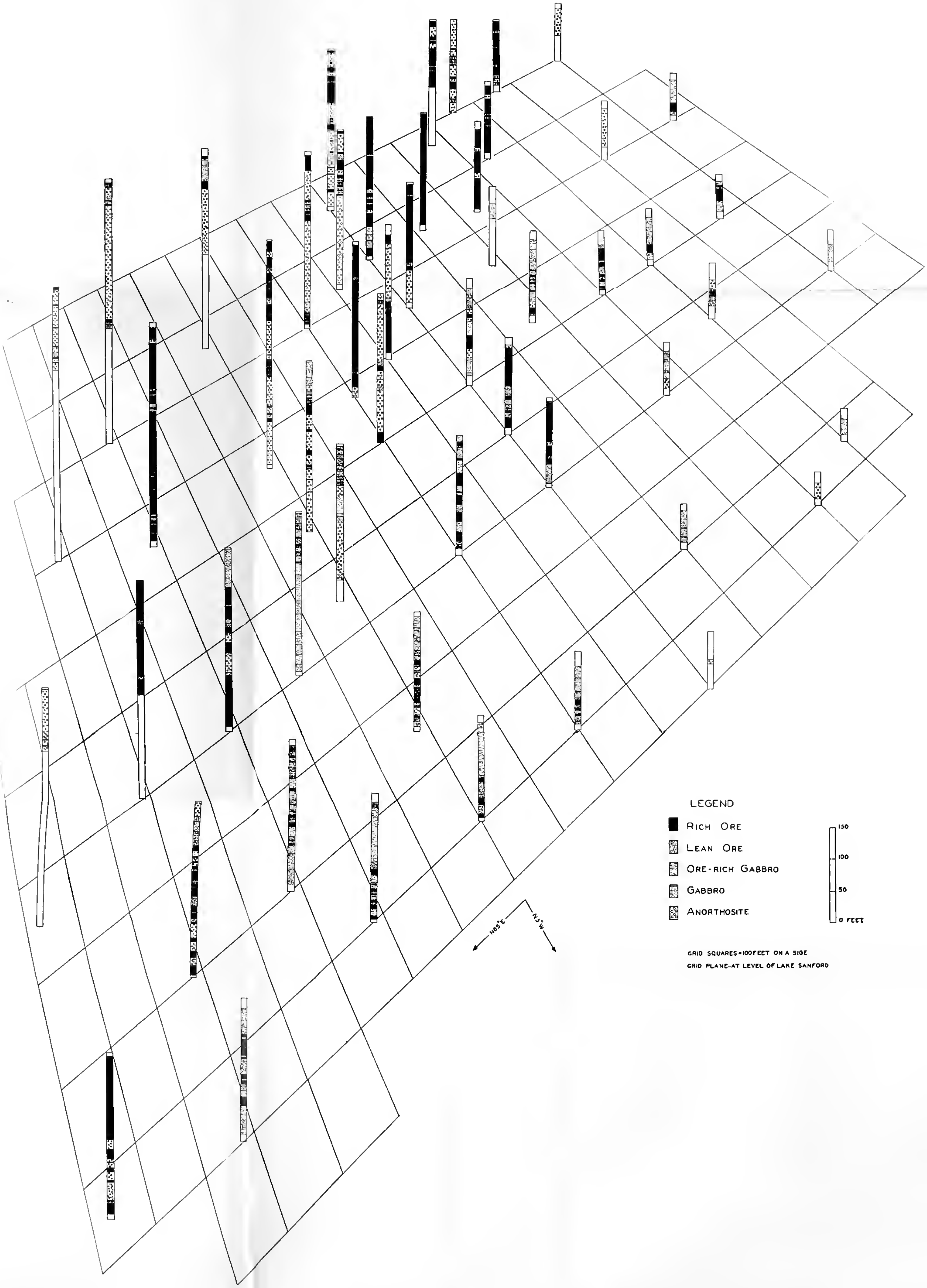

Figure 11 Isometric drawing of the Sanford Hill ore body

Figure 2 Geologic map of the Lake Sanford area

Figure 8 Geologic map of the Sanford Hill ore body

Figure 11 Isometric drawing of the Sanford Hill ore body

The Clinton of Western and Central New York

By

Tracy Gillette Ph.D

Illinois State Geological Survey, Urbana, Ill.

NEW YORK STATE MUSEUM

BULLETIN NUMBER 341

Published by The University of the State of New York

Albany, N. Y. February 1947

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THE CLINTON OF WESTERN AND CENTRAL NEW YORK

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ALBANY

THE UNIVERSITY OF THE STATE OF NEW YORK

1947

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ILLUSTRATIONS

TRACY GILLETTE Ph.D., 1905–42

The talented author of this bulletin, Dr Tracy Gillette, died at his home, Urbana, Ill., November 9, 1942, after a brief illness. He had completed the manuscript for this bulletin several months before his death.

Doctor Gillette was a native of New York State. He had previously prepared for the New York State Museum Bulletin 320 on the Geology of Clyde and Sodus Bay quadrangles, covering his own home area.

THE CLINTON OF WESTERN AND CENTRAL NEW YORK

By

Tracy Gillette Ph. D.

Illinois State Geological Survey, Urbana, Ill.

ACKNOWLEDGMENTS

In the preparation of this report extensive use has been made of the early state reports of James Hall and Lardner Vanuxem. Later state bulletins from which valuable information has been obtained include: Bulletin 114, Geologic Map of the Rochester and Ontario Beach Quadrangles, by C. A. Hartnagel; and Bulletin 123, Iron Ores of the Clinton Formation in New York State, by D. H. Newland and C. A. Hartnagel. Other published reports which have proved of great assistance are: Stratigraphy of the New York Clinton by G. H. Chadwick, which appeared in the Bulletin of the Geological Society of America, volume 29; and reports by C. K. Swartz and E. O. Ulrich and R. S. Bassler, which were published in the Silurian volume of the Maryland Geological Survey.

The writer wishes to acknowledge the hearty support given by the New York State Museum, the University of Rochester and The Johns Hopkins University. Originally the New York State Museum agreed to publish a geologic report and map on the Clyde and Sodus Bay quadrangles. The University of Rochester granted money for field expenses for the mapping and studying of these quadrangles. In the course of the investigation the writer became interested in the stratigraphy of the Clinton and the New York State Museum agreed to publish a report to cover the findings. The Johns Hopkins University agreed to accept the material as a subject for a doctor's dissertation.

The writer is indebted to many individuals, only a few of whom can be enumerated: Dr C. C. Adams, former Director of the New York State Museum, who made possible the publication of this report; C. A. Hartnagel, who not only accompanied the writer in the field and furnished many measured sections which are not now available but also aided in obtaining the diamond drill cores of the New York State Museum for study and furnished engineering data obtained at Lockport, New York, during the construction of the Barge canal in 1905 and 1906; Dr C. K. Swartz, whose helpful criticism has aided in the

preparation of this report; Dr H. L. Alling, who offered many helpful suggestions; Dr R. S. Bassler, who granted permission to study the type Silurian ostracods in the National Museum, which was of great assistance in identifying the numerous Clinton forms; and B. H. Dollen, who furnished considerable information and maps of the Clinton west of the Genesee gorge in Monroe county.

INTRODUCTION

Between the Niagara river and Willowvale, a small village southwest of Utica, the rocks of the Clinton group outcrop in a narrow band approximately two hundred miles long and between five and six miles wide in its broadest extent. The location and areal extent of the Clinton are shown on the accompanying map (figure 1, p. 7).

Except for a limited region in the immediate vicinity of Clinton, New York, where the strata outcrop in the highland to the south of the Mohawk river, the Clinton underlies the plains to the south of Lake Ontario and the low areas surrounding Oneida lake.

The surface of the lowlands bordering these lakes, is covered by a mantle of glacial material. Although this cover is not so thick as it is in some parts of New York State, it is exceptionally even in its distribution. The streams, due to low relief of these plains, have made very little progress in removing this cover. Only here and there where the larger creeks and rivers have succeeded in eroding and carrying away the products of the Pleistocene, and where the streams are not following the courses of some one of the numerous buried preglacial valleys, do the underlying rocks come to the surface.

The greatest single handicap to the stratigraphic geology of the Clinton is Oneida lake. Its waters cover practically the whole belt of Clinton outcrops for a distance of twenty miles and the swamps and alluvial deposits to the east and west of the lake cover about as much more.

Because of the features described in the preceding paragraphs, there are very few places where the entire Clinton can be studied. The best sections are found in the following places: in the Niagara gorge below the falls where it is entirely exposed; in the Genesee gorge at Rochester where there is equally good exposure; on Second and Salmon creeks in the town of Sodus where most of the rocks of this group are uncovered; in the vicinity of Fulton where it is possible by using many small outcrops to piece together a composite section; at Clinton where there are good outcrops of the Upper Clinton formations; and at Willowvale where a nearly complete section is obtainable. For the location of these points see figure 1, page 7.

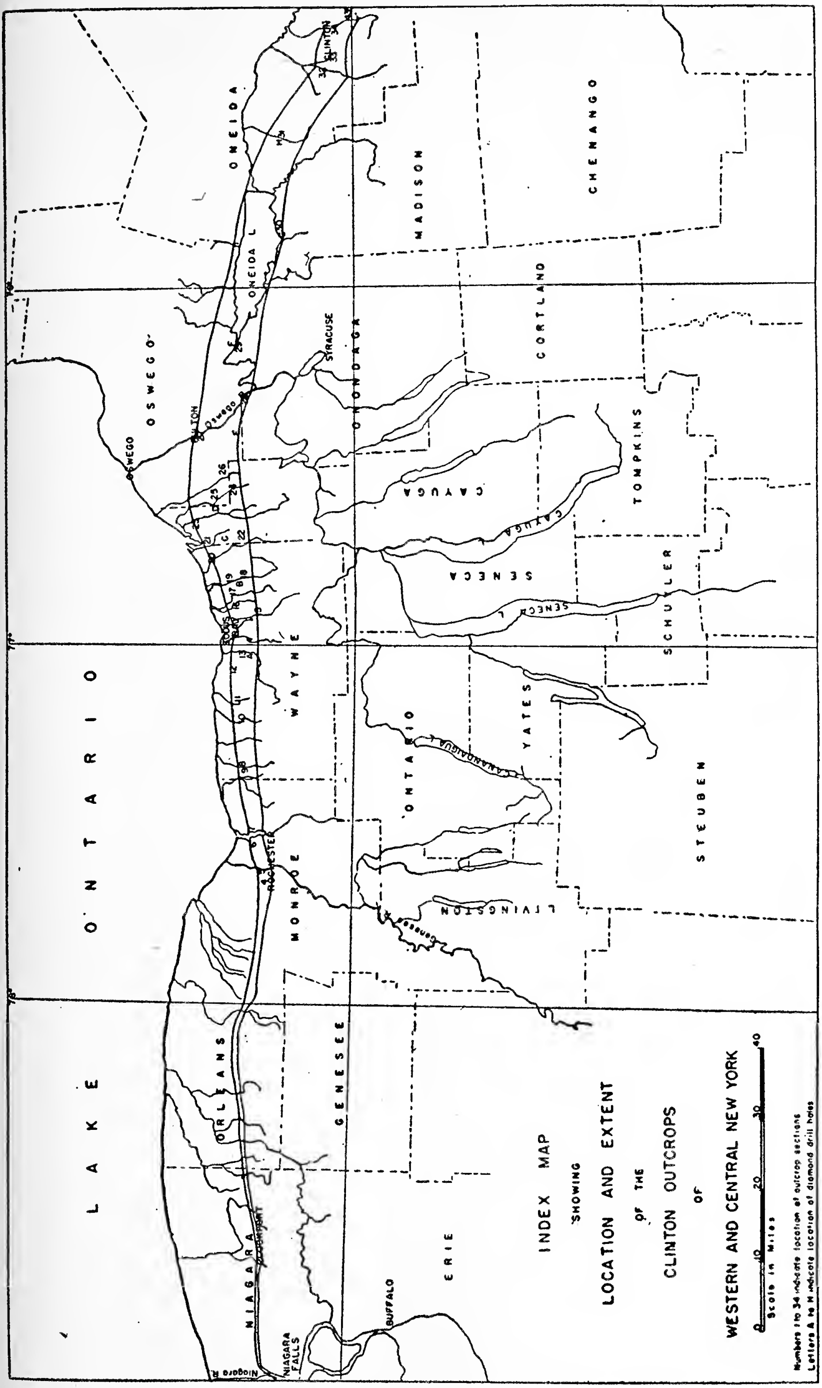

Figure 1 Map showing the location and extent of the Clinton outcrops of western and central New York

The lack of good continuous outcrops has caused a great deal of controversy and speculation concerning the correlation of the Niagara, Rochester and Clinton sections. In preparing this report an attempt has been made, not only to study more carefully the fauna both megascopic and microscopic of the well-known exposures, but also to study with equal care the small isolated and little known outcrops. The diamond drill cores, which were put down by the State of New York for the exploration of the Clinton iron ore resources and which were made available through the courtesy of the New York State Museum and C. A. Hartnagel, were a great aid in obtaining a clear picture of the general stratigraphic relations in the area where most of the Clinton is covered. Furthermore, these cores helped immeasurably in locating stratigraphically the smaller isolated outcrops.

HISTORICAL REVIEW

The region covered by this report has been the subject of many papers in the past. In Amos Eaton's ('29, p. 1–163) monograph the rocks of the Clinton age were included in his Secondary Ferriferous Slate and Sandstone. This publication is of little value except for historic interest.

The term, Clinton group, was first proposed by Vanuxem ('39, p. 249). Previously he had included the same rocks in his Protean group, which also ('42, p. 80) embraced the Niagara and Lockport limestone and shale. These latter formed the upper part of the Protean, and they were separated on account of their importance in the west and their supposed disappearance in Herkimer county. The name Clinton was given to the lower part of the Protean because of its characteristic development around the village of Clinton in Oneida county and as a tribute to Governor DeWitt Clinton.

James Hall ('43, p. 58–117), whose final report appeared a year later, accepted Vanuxem's Clinton group. For each of the important outcrops he gave a description of the lithology and listed and illustrated the fossils characteristic of each type of rock. James Hall's ('52, p. 15–105) Paleontology of the Clinton is a work the value of which can not be over-estimated. The plates and descriptions must even now be accepted as the basis for all work on the fauna of the group.

Hartnagel ('07, p. 12–19) in 1907 assigned local names to the lithologic units occurring in the Genesee gorge at Rochester and traced these units into Wayne county. He gave a list of fossils common to the various types of lithology.

Under the supervision of Newland and Hartnagel ('08, p. 1–76)

the State of New York put down a series of test holes for the purpose of exploring the Clinton iron ore resources. Because these test holes were located in an area covered by drift, the data obtained from them has been used directly or indirectly in all the succeeding papers.

Chadwick ('18, p. 327–68) was the first to attempt a complete correlation of the Clinton and Rochester sections. This valuable work served to stimulate interest in the Clinton and show the possibilities of detailed correlation.

Ulrich and Bassler ('23, p. 324–52) also published a correlation of the Rochester and Clinton sections. Their greatest contribution was, however, the establishing and defining of certain ostracod zones in the Clinton. Some of these zones they were able to locate in the New York area.

More recently Sanford ('35, p. 169–83 and '36, p. 797–814) has proposed a new and interesting correlation of the Clinton.

Table 1, pages 10 and 11, summarizes the classification of the Clinton strata as given by various authors. From this table the evolution of the various divisions and names can be seen.

GENERAL CHARACTERISTICS OF THE CLINTON GROUP

LIMITS

The lower boundary of the Clinton group is placed by the writer at the base of the Thorold sandstone in western New York and immediately below the Oneida conglomerate in central New York. The group is terminated with the Rochester shale in western New York and with its eastern equivalent, the Herkimer sandstone, in central New York.

Vanuxem ('42, p. 75–78, 80) who was the first to use the Clinton as a group name, established these same upper and lower limits in central New York. In western New York he rightly considered the gray band (Thorold sandstone) the equivalent of the Oneida and therefore a part of his Clinton group. He failed to correlate the Herkimer and Rochester of this area and for this reason excluded the latter from his group. He definitely established, however, a type locality and described the strata in some detail. Since the Rochester can now be shown to be equivalent to certain beds of his Clinton at its type locality, it would seem only logical to include it.

Quite aside from any historical usage the evidence as presented by the rocks themselves appears to harmonize with the proposed boundaries. At the base, spread over western New York as far east as Oswego county, is a thin but continuous, blanketlike formation, the Thorold sandstone. Eastward it grades into the Oneida. The two

TABLE I

CLINTON NOMENCLATURE

VANUXEM-1842	NEW YORK SYSTEM; ONTARIO DIVISION	NIAGARA GROUP	CLINTON GROUP	ONEIDA CONGLOMERATE; MEDINA SANDSTONE
HALL-1843	NEW YORK SYSTEM; ONTARIO DIVISION	NIAGARA GROUP: NIAGARA LIMESTONE, NIAGARA SHALE	CLINTON GROUP	MEDINA SANDSTONE
DANA-1863	SILURIAN AGE OR AGE OF MOLLUSCA; UPPER SILURIAN; NIAGARA PERIOD	NIAGARA EPOCH	CLINTON EPOCH	MEDINA EPOCH
CLARKE & SCHUCHERT-1893	ONTARIC OR SILURIC SYSTEM; NIAGARAN OR MESONTARIC PERIOD OR GROUP (Niagara and Clinton); OSWEGAN OR PALEONTARIC (Medina)	LOCKPORT LIMESTONE; ROCHESTER SHALE	CLINTON BEDS	MEDINA SANDSTONE
HARTNAGEL-1907	ONTARIC OR UPPER SILURIC SYSTEM; NIAGARAN GROUP (Niagara and Clinton); OSWEGAN (Medina)	NIAGARA: LOCKPORT DOL. INCL. GUELPH; ROCHESTER SHALE	CLINTON BEDS: IRONDEQUOIT LS.; WILLIAMSON SHALE; WOLCOTT LS.; FURNACEVILLE ORE; SODUS SHALE	MEDINA BEDS: ONEIOA CONGLOMERATE; MEDINA RED SHALES; OSWEGO SANDSTONE
GRABAU-1908	SILURIAN; LOWER SILURIC OR NIAGARAN	LOCKPORT; ROCHESTER	CLINTON: CLINTON LIMESTONES ANO SHALES	MEDINA SANOSTONE INCLUOING ONEIOA CONG.
CHADWICK-1908	SILURIAN; EONTARIC; NIAGARAN	LOCKPORT; ROCHESTER INCLUDING IRONDEQUOIT	CLINTON BEDS: WILLIAMSON; WOLCOTT INCLUDING FURNACEVILLE; SODUS	MEDINA

Table 1 Clinton nomenclature

TABLE I

CLINTON NOMENCLATURE

C. SCHUCHERT-1910

SILURIAN OR ONTARIC PERIOD	NIAGARA SERIES		LOCKPORT
			ROCHESTER
			IRONDEQUOIT
		CLINTON GROUP	WILLIAMSON
			WOLCOTT
			FURNACEVILLE
			SODUS
	ANTICOSTIAN OR ALEXANDRIAN		MEDINA
			(ONEIDA)

CHADWICK - 1918

EONTARIC OR ANTICOSTIAN	UPPER EONTARIC OR?			NOT GIVEN
		CHICH'E		GATES ROCHESTER
		JUPITER	U. CLINTON	LAKEPORT
				DONNELLY PHOENIX KIRKLAND BREWERTON WILLIAMSON
	LOWER EONTARIC OR?	GUNRIVER	LOWER CLINTON	WOLCOTT FURNACE
				WOLCOTT VERONA SODUS STERLING STA. REYNALES FURNACEVILLE
		BECSIE RIVER		MAPLEWOOD
				THOROLD
			MEDINA	GRIMSBY

GRABAU - 1921

SILURIAN SYSTEM	LOWER SILURIAN	U. NIAGARAN		LOCKPORT DOL.&LS
				ROCHESTER
		MIDDLE NIAGARAN	CLINTON	IRONDEQUOIT
				WILLIAMSON
				WOLCOTT
				FURNACEVILLE
				SODUS
		L. NIAGARAN		MEDINA
				THOROLD
				MEDINA SS&SH.

ULRICH BASSLER - 1923

SILURIAN SYSTEM	NIAGARAN SERIES	LOCKPORT		DOES NOT APPLY TO NEW YORK
		CLINTON GROUP	LAKEMONT	ROCHESTER
				IRONDEQUOIT
				WILLIAMSON
				MIDDLE CLINTON
			LOWER CLINTON	WOLCOTT
				SODUS
				BEAR CREEK
				REYNALES
				MAPLEWOOD
				THOROLD
	MEDINAN	AL'NDRIA		BRASSFIELD

GOLDRING - 1931

SILURIAN OR ONTARIAN	NIAGARAN SERIES		LOCKPORT INCLUDING GUELPH
		CLINTON BEDS	ROCHESTER SHALE
			IRONDEQUOIT LS.
			WILLIAMSON SH.
			MIDDLE CLINTON LS.& SH. (WOLCOTT ORE) WOLCOTT LS.
			SODUS (STERLING ORE)
			BEAR CREEK
			REYNALES (FURNACEVILLE O.)
			MAPLEWOOD
			THOROLD ONEIDA
	MEDINAN	ALBION	UPPER MEDINA BEDS

SANFORD - 1936

SILURIAN	NIAGARA GROUP	LOCKPORT
		ROCHESTER
		IRONDEQUOIT
	CLINTON GROUP	WILLIAMSON OTSQUAGO SAUQUOIT ONEIDA WOLCOTT
		SODUS
		REYNALES
		MAPLEWOOD NEAHGA
	MEDINA GROUP	THOROLD
		ALBION

GILLETTE - 1942

SILURIAN SYSTEM	NIAGARAN SERIES			LOCKPORT
		CLINTON GROUP	UPPER CLINTON	ROCHESTER HERKIMER KIRKLAND
				IRONDEQUOIT
				WILLOWVALE
				WILLIAMSON WESTMORELAND
			M	SAUQUOIT
			LOWER CLINTON	WOLCOTT FURNACE
				WOLCOTT
				UPPER SODUS
				LOWER SODUS
				REYNALES FURNACEVILLE
				MAPLEWOOD NEAHGA
				THOROLD ONEIDA
	MEDINAN	ALBION G.		GRIMSBY

Table 1 Clinton nomenclature

formations appear to represent the initial deposits of the Clinton sea as it advanced over the semicontinental Grimsby of the underlying Albion group. Above the Thorold in western New York are alternating shales and limestones with thin iron ores. Above the Oneida is a succession of shales, silty shales and sandstones with similar iron ores. The sediments of the Clinton are everywhere marked by lateral and vertical variations. These variations can only be explained as the result of rapidly changing conditions under which the sediments were deposited. In contrast the overlying Lockport is composed of fairly uniform limestones and dolomites throughout its entire lateral and vertical extent. Such uniform sediments could only have formed under fairly widespread and stable marine conditions.

The boundaries of the Clinton have been the subject of much discussion in the past. Table 1, page 10 and 11, gives a brief summary of the views of various authors. A more complete review of this problem can be found in an earlier publication (Gillette, '40, p. 23, 24, 30–35).

SUBDIVISIONS OF THE CLINTON

General Divisions

On their distribution, faunal content and general characteristics, the rocks of the Clinton can be roughly divided into the Lower, Middle and Upper Clinton. The Lower Clinton is well-developed in western New York. In the area of outcrop its present maximum thickness is in Oswego county. The Middle Clinton occupies a relatively narrow area of outcrop in central New York. The maximum development of this part of the group is in the vicinity of Clinton. No trace of the Middle Clinton can be found west of eastern Wayne county. The Upper Clinton is present in outcrops both in central and western New York. It overlaps the strata of the Lower and Middle Clinton. It reaches its maximum thickness in the area of outcrop near the Cayuga and Wayne county lines (see figure 2, p. 13).

Similar divisions were recognized by Ulrich and Bassler ('23, p. 324-25), but they gave the Upper, Middle and Lower Clinton the rank of formations. This practice does not appear justifiable in New York State, particularly so if formations are used as strictly lithologic divisions. The Lower Clinton contains at least ten lithologic units which are distinct enough in themselves to be called formations, and which are certainly mapable units. The Upper, Middle and Lower Clinton are useful theoretical divisions based upon fossil assemblages and unconformities within the Clinton group and are in no way concerned with the lithology of the rocks.

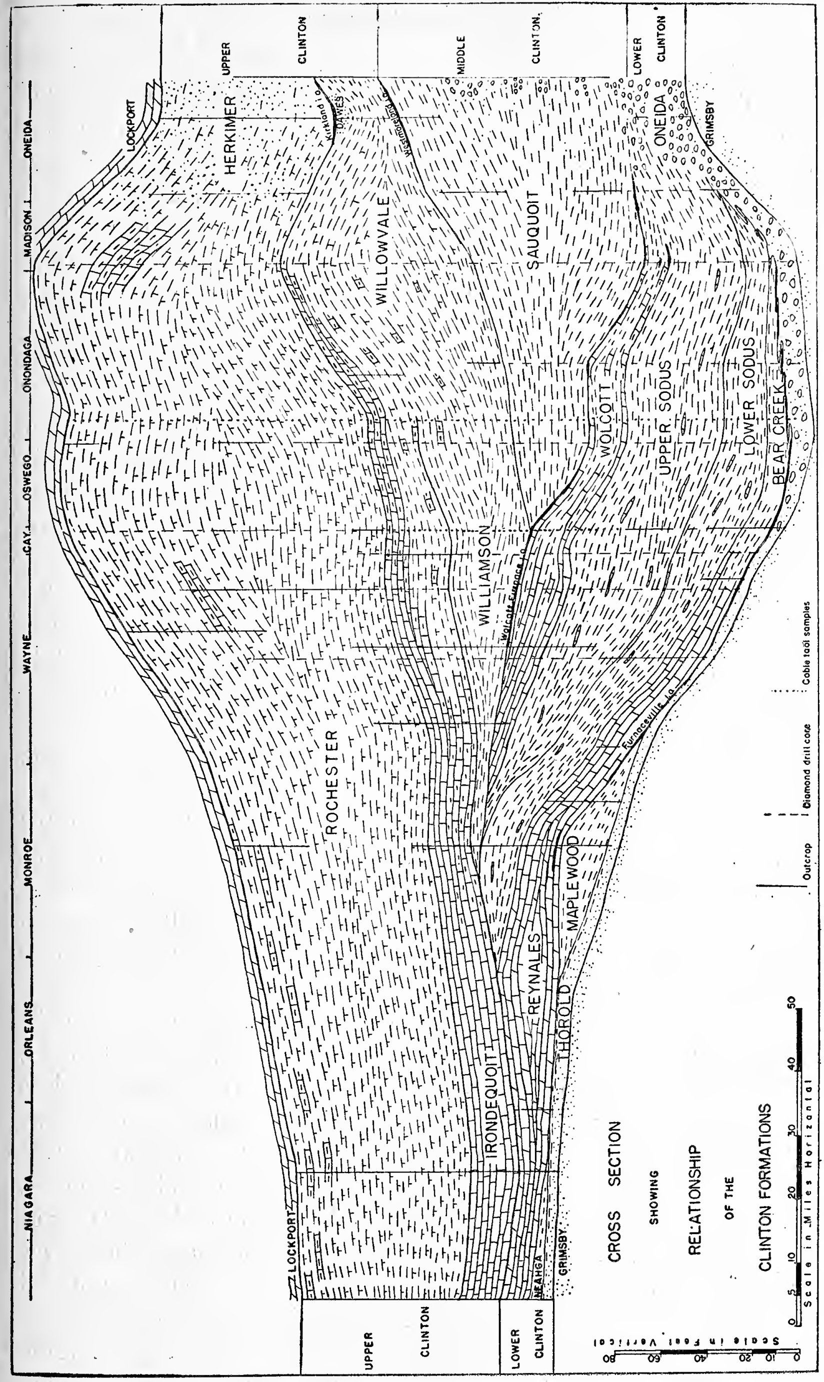

Figure 2 Cross section showing relationship of the Clinton formations

Lithologic Divisions

The Clinton can be divided into formations on the basis of lithology. The only aim of such subdivisions is to establish easily recognizable and descriptive units which are based, so far as possible, on objective rather than interpretative reasoning. If characteristics other than lithology are allowed to govern the divisions, then interpretative reasoning must have the dominating role. The object of any geologic report is to interpret the geology of the region in terms of the formations. For this reason the formations themselves must be as objective as possible.

Most of the true lithologic units or formations have already been assigned adequate names. More than a hundred years ago Hall ('39, p. 290) designated the Upper Clinton shales of western New York as the Rochester. A few years later Vanuxem ('42, p. 75–78) introduced the term Oneida for the basal conglomerate. Hartnagel ('07, p. 12–17) named and assigned type localities to the Sodus, the Furnaceville, the Williamson and the Irondequoit. Grabau ('13, p. 460) correlated the gray band of Hall ('43, p. 34–57) with a certain sandstone in Ontario and gave it the designation, Thorold sandstone. Chadwick ('18, p. 327–66) in introducing the Maplewood, Bear Creek, Reynales, Wolcott Furnace, Sauquoit, Kirkland and Herkimer provided names for most of the remaining unnamed units. Sanford ('35, p. 169) added the term Neahga (see table 1, p. 10, 11). The writer ('40, p. 54–63) divided the Sodus into the Upper and Lower Sodus. Only three additional formation names appear necessary. It is suggested that the oolitic iron ore in the vicinity of Clinton village be called the Westmoreland, that the dark gray to green, calcareous shale immediately overlying the Westmoreland be termed the Willowvale, and that the light gray cross-bedded sandstone overlying the Willowvale be designated as the Dawes sandstone.

The recognized formations are listed in table 2, page 15. In the Niagara gorge three formations are accredited to the Lower Clinton, the Thorold, Neahga and Reynales. Eastward the Maplewood in Monroe county occupies a stratigraphic position similar to the Neahga of the Niagara area. The Furnaceville and the Lower Sodus shale appear in the section. In Wayne county the Maplewood disappears, but the Upper Sodus shale, the Wolcott limestone and the Wolcott Furnace iron ore are added. Eastward from Wayne county the Lower Clinton formations soon begin disappearing and in Oneida county all that remains of the Lower Clinton is the Oneida conglomerate.

In the Middle Clinton only two formations are recognized, the Sauquoit shale and the Oneida conglomerate. Only the upper portion

TABLE 2

CLINTON FORMATIONS

	NIAGARA COUNTY	MONROE COUNTY	WAYNE COUNTY	ONEIDA COUNTY
UPPER	ROCHESTER SHALE	ROCHESTER SHALE	ROCHESTER SHALE	HERKIMER SANDSTONE
				KIRKLAND IRON ORE
	IRONDEQUOIT LIMESTONE	IRONDEQUOIT LIMESTONE	IRONDEQUOIT LIMESTONE	WILLOWVALE SHALE
		WILLIAMSON SHALE	WILLIAMSON SHALE	
				WESTMORELAND IRON ORE
MIDDLE				SAUQUOIT SHALE
LOWER			WOLCOTT FURNACE IRON ORE	ONEIDA CONGLOMERATE
			WOLCOTT LIMESTONE	
			UPPER SODUS SHALE	
		LOWER SODUS SHALE	LOWER SODUS SHALE	
	REYNALES LIMESTONE	REYNALES LIMESTONE	REYNALES LIMESTONE	
		FURNACEVILLE IRON ORE	FURNACEVILLE IRON ORE	
	NEAHGA SHALE	MAPLEWOOD SHALE		
	THOROLD SANDSTONE	THOROLD SANDSTONE	THOROLD SANDSTONE	

Table 2 Clinton formations

of the Oneida conglomerate is Middle Clinton (see p. 15). The Middle Clinton does not outcrop west of Verona, Oneida county, but it can be traced by well logs as far as South Granby, Oswego county.

The Upper Clinton of Niagara county consists of two formations, the Rochester shale and the Irondequoit limestone. In Monroe county the Williamson shale appears at the base of the Irondequoit. These same formations continue eastward to Oneida county. In this region the Herkimer sandstone with the Kirkland iron ore at its base is seen occupying a position equivalent to the Rochester shale. The Willowvale shale has a stratigraphic position equivalent to the Irondequoit and part of the Williamson. The Westmoreland iron ore is situated at the base of the Upper Clinton in Oneida county.

Faunal Zones

Important divisions can be established in the Clinton on the fauna occurring in the rocks without regard to lithology. Such subdivisions based upon fossil evidence are called zones.

All fossil zones are considered to carry a certain time connotation. Under the most ideal conditions such zones would represent the rocks deposited within the life span of a single species or group of allied species. If time were the only factor in determining the presence or absence of fossils in the rocks, far more weight could be placed upon faunal zones. Evidence, however, points to the conclusion that other factors were involved in the present distribution of fossils. In the first place there is every reason to believe that ecology played a selective role in the past as in the present. Then also the sediments forming under varying conditions were not equally successful in preserving the evidences of past life.

That ecologic conditions did influence the organisms which lived in the Clinton seas can best be demonstrated by a few of the many examples. Take for instance the well-known brachiopod, *Pentamerus oblongus*. This form is found in two formations of the Lower Clinton, the Reynales and the Wolcott limestones. The fossils are not only confined to the separated formations (see table 2, p. 15), but they are even restricted to very definite portions within the formations themselves. In the Genesee gorge (section 5, p. 127) the Reynales has six layers containing *Pentamerus*. These are separated by rock containing no *Pentamerus*. In other sections (see section A, p. 175) the same alternation of *Pentamerus* with non-*Pentamerus*-bearing rock is observed. That the lateral extent of any one of those *Pentamerus*-bearing portions of either the Reynales or the Wolcott is not great is shown by the impossibility of tracing these horizons from outcrop to

outcrop. The sporadic occurrence of the *Pentamerus* certainly suggests strongly that they required a very special type of ecology and when, and only when, such living conditions existed did they flourish.

The brachiopod, *Bilobites biloba,* is another type whose present occurrence strongly suggests that either its very existence or at least its preservation must have been influenced by the conditions which were present in the Clinton seas. This odd-shaped fossil is not found except in calcareous, nonsilty, weak, crumbly shale layers. In such rock they are often abundant and if not alone, associated with very few other fossils. The *Bilobites*-bearing layers average less than two inches in thickness and never constitute the major portion of any given section. The very character of the shale suggests a unique condition of deposition. The distribution of *Bilobites* does not prove, however, that this form grew only under the conditions suitable to the deposition of these shales. The shells of this fossil are delicate and extremely fragile, and it is possible that the shale represents the only type of lithology in which they could be easily preserved. Whether the occurrence is due to a suitable environment or to the lack of preservation, the range of any fossil having such rigid requirements is of questionable value in determining the age or in correlating formations.

The present-known distribution of the trilobite, *Dalmanites limulurus,* shows the fallacy of placing too much emphasis on the range of any given species. Because the section around Rochester has been studied more carefully than any other section of the Clinton in the State, this fossil has been considered by many as a guide fossil for the Rochester shale. It is true that the fossil appears to be confined to the Rochester, but this can be explained by the type of rock present in that area. In the Genesee gorge the Rochester shale is underlain by a crystalline, crinoidal limestone, the Irondequoit, and that in turn by the graptolite-bearing shales of the Williamson. Neither of these appear to have been formed in environments which were favorable to the growth and preservation of *D. limulurus.* To the east of Monroe county, the conditions of sedimentation were different and *D. limulurus* is found throughout the whole thickness of the Upper Clinton. Furthermore, the careful collection and study of a large number of species failed to show any difference whatsoever between those specimens collected from the Rochester and the ones found in the underlying formations.

The faunal tables (table 3, p. 18–21) point to the conclusion that the common ostracods are better suited for the purpose of zoning than any other class of organisms. They have a short vertical range. They occur in such numbers in the rocks that the presence or absence of a given group can be easily checked. They are found in shales, lime-

TABLE 3 FAUNAL TABLES	UPPER CLINTON																																						M.		LOWER CLINTON																																											
	ROCHESTER														HERK				KIRK			IRONDEQUOIT								WILLIAMSON							WIL	W	SAU		W.F.	WOLCOTT						UPPER SODUS								L. SODUS				REYNALES										B. CR			FURNACEVILLE									MN	
	Niagara G.	Lockport	Densmore C.	Salmon C.W.	Mink C.	Salmon C.E.	Second C.	Sodus C.	Beaver C.	Walcott C.	L. Walcott C.	Blind Sodus C.	L. Sodus C.	Oneida Lake	Stony C.	College Hill C.	Dawes Quarry C.	Willowvale	College Hill C.	Dawes Quarry C.	Willowvale	Niagara G.	Lockport	Genesee G.	Salmon C.W.	Second C.	Beaver C.	L. Walcott C.	Blind Sodus C.	Genesee G.	Salmon C.W.	Second C.	L. Walcott C.	Phoenix	Brewerton	Dawes Quarry C.	Willowvale	Dawes Quarry C.	Stony C.	Willowvale	Second C.	Stony C.	Fish C.	Salmon C.W.	Second C.	Mudge C.	L. Walcott C.	Fish C.	Salmon C.E.	Second C.	Mudge C.	L. Walcott C.	L. Sodus C.	Sterling Valley C.	Stony C.	Genesee G.	Salmon C.E.	Bear C.	Martville	Niagara G.	Lockport	Johnson C.	Genesee G.	Densmore C.	Glen Edyth	Fruitland	Weed C.	Mink C.	Salmon C.E.	Bear C.	Sterling Station	Martville	Genesee G.	Densmore C.	Fruitland	Weed C.	Mink C.	Salmon C.E.	Bear C.	Sterling Station	Martville	Densmore C.	Niagara G.
PLANTS																																																																																			
Buthotrephis gracilis (Hall)																																																																																			
B. palmata Hall																																																																																			
B. ramosa Hall																																																																																			
Palaeophycus striatum Hall																																																																																			
Rusophycus biloba (Vanuxem)																																																																																			
R. pudicum Hall																																																																																		
R. subangulatum Hall																																																																																			
COELENTERATA																																																																																			
ANTHOZOA																																																																																			
Palaeocyclus rotuloides (Hall)																																																																																			
Enterolasma caliculum (Hall)																																																																																			
Zaphrentis bilateralis (Hall)																																																																																				
Z. turbinata (Hall)																																																																																				
Cystiphyllum niagarense (Hall)																																																																																			
Cladopora seriata Hall																																																																																				
Favosites constrictus (Hall)																																																																																				
F. favosideus (Hall)																																																																																				
F. hisingeri Edwards & Haime																																																																																				
F. pyriformis (Hall)																																																																																				
Striatopora flexuosa Hall																																																																																				
Cannapora junciformis Hall																																																																																				
Chaetetes lycoperdon Hall																																																																																				
HYDROZOA																																																																																				
Stromatopora constellata Hall																																																																																				
GRAPTOLITOIDEA																																																																																				
Dictyonema gracile Hall																																																																																				
D. retiforme (Hall)																																																																																				
D. subretiforme (Spencer)																																																																																				
Retiolites geinitzianus venosus (Hall)																																																																																				
Monograptus clintonensis (Hall)																																																																																				
ECHINODERMATA																																																																																				
CYSTOIDEA																																																																																				
Caryocrinites ornatus Say																																																																																				
CRINOIDEA																																																																																				
Dimerocrinus brachiatus (Hall)																																																																																				
D. liliiformis (Hall)																																																																																				
Lyriocrinus dactylus (Hall)																																																																																				
Eucalyptocrinus caelatus (Hall)																																																																																				
Lecanocrinus macropetalus Hall																																																																																				
Ichthyocrinus laevis Conrad																																																																																				
Stephanocrinus angulatus Conrad																																																																																				
S. gemmiformis Hall																																																																																				
Dendrocrinus longidactylus Hall																																																																																				
MOLLUSCOIDEA																																																																																				
BRYOZOA																																																																																				
Diploclema sparsum (Hall)																																																																																				
Ceramopora imbricata Hall																																																																																				
Coelaclema cavernosum Bassler																																																																																				
Spatiopora maculata (Hall)																																																																																				
Chilotrypa ostiolata (Hall)																																																																																				
Fistulipora crustula Bassler																																																																																				
F. tuberculosa (Hall)																																																																																				
Mesotrypa nummiformis (Hall)																																																																																				
Batostomella granulifera (Hall)																																																																																				
Eridotrypa solida (Hall)																																																																																				
E. striata (Hall)																																																																																				
Lioclema asperum (Hall)																																																																																				
Trematopora tuberculosa Hall																																																																																				
Chasmatopora angulata (Hall)																																																																																					
C. asperatostriata (Hall)																																																																																				
Pseudohornea diffusa (Hall)																																																																																				
Fenestella elegans Hall																																																																																					
F. tenuis Hall																																																																																					
Polypora incepta Hall																																																																																					
Semicoscinium tenuiceps (Hall)																																																																																				

Table 3 Faunal tables

FAUNAL TABLES

UPPER CLINTON	ROCHESTER	Niagara G, Lockport, Densmore C, Salmon C W, Mink C, Salmon C E, Second C, Sodus C, Beaver C, Wolcott C, L Wolcott C, Blind Sodus C, L Sodus C, Oneida Lake
UPPER CLINTON	HERK	Stony C, College Hill C, Dowes Quarry C, Willowvale
UPPER CLINTON	KIRK	College Hill C, Dowes Quarry C, Willowvale
UPPER CLINTON	IRONDEQUOIT	Niagara G, Lockport, Genesee G, Salmon C W, Second C, Beaver C, L Wolcott C, Blind Sodus C
UPPER CLINTON	WILLIAMSON	Genesee G, Salmon C W, Second C, L Wolcott C, Phoenix, Brewerton, Dowes Quarry C
UPPER CLINTON	WIL	Willowvale
M	SAU	Dowes Quarry C, Stony C, Willowvale
LOWER CLINTON	W.F.	Second C, Stony C
LOWER CLINTON	WOLCOTT	Fish C, Salmon C W, Second C, Mudge C, L Wolcott C
LOWER CLINTON	UPPER SODUS	Fish C, Salmon C E, Second C, Mudge C, L Wolcott C, L Sodus C, Sterling Valley C, Stony C
LOWER CLINTON	L SODUS	Genesee G, Salmon C E, Bear C, Martville
LOWER CLINTON	REYNALES	Niagara G, Lockport, Johnson C, Genesee G, Densmore C, Glen Edyth, Fruitland, Weed C, Mink C, Salmon C E
LOWER CLINTON	B. CR	Bear C, Sterling Station, Martville
LOWER CLINTON	FURNACEVILLE	Genesee G, Densmore C, Fruitland, Weed C, Mink C, Salmon C E, Bear C, Sterling Station, Martville
LOWER CLINTON	M.N.	Densmore C, Niagara G

Heliopora fragilis Hall
Nematopora raripora (Hall)
Acanthoclema asperum (Hall)
Clathropora frondosa Hall
Phaenopora constellata Hall
P. ensiformis Hall
P. explanata Hall
Pachydictya crassa Hall
Diamesopora dichotoma Hall
Lichenalia concentrica Hall
Rhinopora verrucosa Hall
Stictotrypa punctipora (Hall)
BRACHIOPODA
Lingula clintoni Vanuxem
L. lamellata Hall
L. oblata Hall
L. (Palaeoglossa) perovata (Hall)
Schizotreta tenuilamellata (Hall)
Pholidops squamiformis (Hall)
Dalmanella elegantula (Dalman)
Orthis flabellites Foerste
O. (?) punctostriata Hall
O. (?) tenuidens Hall
Orthostrophia (Schizoramma) fasciata (Hall)
Platystrophia biforata (Schlotheim)
P. lynx (Eichwald)
Bilobites biloba (Linnaeus)
Rhipidomella circulus Hall
R. hybrida (Sowerby)
Leptaena rhomboidalis (Wilckens)
Sowerbyella transversalis (Wahlenberg)
Rafinesquina (?) obscura Hall
Schuchertella elegans (Prouty)
S. interstriata (Hall)
S. subplana (Conrad)
S. tenuis (Hall)
Stropheodonta corrugata (Conrad)
S. deflecta (Prouty)
S. prisca Hall
S. (Brachyprion) profunda (Hall)
Strophomena (?) orthididea (Hall)
Strophonella (?) patenta (Hall)
S. striata (Hall)
Chonetes cornutus (Hall)
Scenidium pyramidale Hall
Anastrophia brevirostris (Hall)
A. interplicata (Hall)
Clorinda fornicata (Hall)
Pentamerus oblongus (Sowerby)
P. ovalis Hall
Dictyonella corallifera (Hall)
Camarotoechia (?) acinus Hall
C. aequiradiata (Hall)
C. (Stegerhynchus) neglecta (Hall)
C. obtusiplicata (Hall)
C. pisa (Hall & Whitfield)
Rhynchonella (?) bidens Hall
R. (?) bidentata (Hisinger)
R. (?) emacerata (Hall)
R. plicatella (Linnaeus)
Rhynchotreta cuneata americana (Hall)
R. robusta (Hall)
Atrypa (?) gibbosa Hall
A. nodostriata Hall
A. reticularis (Linnaeus)
A. rugosa Hall
Atrypina disparilis (Hall)

Table 3 Faunal tables

FAUNAL TABLES	UPPER CLINTON																																						M.		LOWER CLINTON																																									
	ROCHESTER														HERK				KIRK			IRONDEQUOIT								WILLIAMSON						WIL		W	SAU		W.F		WOLCOTT					UPPER SODUS								L. SODUS				REYNALES										B. CR			FURNACEVILLE									M	N
	Niagara G.	Lockport	Densmore C.	Salmon C.W.	Mink C.	Salmon C.E.	Second C.	Sodus C.	Beaver C.	Wolcott C.	L. Wolcott C.	Blind Sodus C.	L. Sodus C.	Oneida Lake	Stony C.	College Hill C.	Dawes Quarry C.	Willowvale	College Hill C.	Dawes Quarry C.	Willowvale	Niagara G.	Lockport	Genesee G.	Salmon C.W.	Second C.	Beaver C.	L. Wolcott C.	Blind Sodus C.	Genesee G.	Salmon C.W.	Second C.	L. Wolcott C.	Phoenix	Brewerton	Dawes Quarry C.	Willowvale	Dawes Quarry C.	Stony C.	Willowvale	Second C.	Stony C.	Fish C.	Salmon C.W.	Second C.	Mudge C.	L. Wolcott C.	Fish C.	Salmon C.E.	Second C.	Mudge C.	L. Wolcott C.	L. Sodus C.	Sterling Valley C.	Stony C.	Genesee G.	Salmon C.E.	Bear C.	Martville	Niagara G.	Lockport	Johnson C.	Genesee G.	Densmore	Glen Edyth	Fruitland	Weed C.	Mink C.	Salmon C.E.	Bear C.	Sterling Station	Martville	Genesee G.	Densmore C.	Fruitland	Weed C.	Mink C.	Salmon C.E.	Bear C.	Sterling Station	Martville	Densmore C.	Niagara G.
Cyrtia exporrecta myrtia (Billings)																																																																																		
C. meta (Hall)																																																																																		
Reticularia bicostata (Vanuxem)																																																																																		
Spirifer (Delthyris) crispatus (Hall & Clarke)																																																																																		
S. (Delthyris) crispus (Hisinger)																																																																																		
S. (Delthyris) sulcatus (Hisinger)																																																																																		
S. (Eospirifer) eudora (Hall)																																																																																		
S. (Eospirifer) niagarensis (Conrad)																																																																																		
S. (Eospirifer) radiatus (Sowerby)																																																																																		
S. (Eospirifer) repertus (Foerste)																																																																																		
Cyrtina pyramidalis (Hall)																																																																																		
Homoeospira apriniformis Hall																																																																																		
Trematospira camura Hall																																																																																		
Hyattidina congesta (Conrad)																																																																																		
Nucleospira pisiformis Hall																																																																																		
Whitfieldella cylindrica Hall																																																																																		
W. intermedia (Hall)																																																																																		
W. (?) naviformis (Hall)																																																																																		
W. nitida (Hall)																																																																																		
W. nitida oblata (Hall)																																																																																		
Coelospira hemispherica (Sowerby)																																																																																		
C. plicatula (Hall)																																																																																		
C. sulcata Prouty																																																																																		
MOLLUSCA																																																																																		
PELECYPODA																																																																																		
Cuneamya alveata Whitfield & Hovey																																																																																		
Ctenodonta elliptica (Hall)																																																																																		
C. ? lata (Hall)																																																																																		
C. machaeriformis (Hall)																																																																																		
C. mactriformis (Hall)																																																																																		
Pyrenomoeus cuneatus Hall																																																																																		
Cyrtodonta ? alata (Hall)																																																																																		
Leptodesma rhomboidea (Hall)																																																																																		
Leiopteria subplana (Hall)																																																																																		
Pterinea emacerata (Conrad)																																																																																		
P. undata (Hall)																																																																																		
Amphicoelia orbiculoides (Grabau)																																																																																		
Mytilarca mytiliformis (Hall)																																																																																		
Modiolopsis ovata Hall																																																																																		
M. subalata Hall																																																																																		
M. subcarinata Hall																																																																																		
Orthodesma curtum (Hall)																																																																																		
Cypricardinia undulostriata (Hall)																																																																																		
GASTROPODA																																																																																		
Bucanella trilobata (Conrad)																																																																																		
Bucania bellapuncta Hall																																																																																		
B. stigmosa Hall																																																																																		
Hormotoma subulata (Conrad)																																																																																		
H. sulcatum (Conrad)																																																																																		
Cyclonema varicosum Hall																																																																																		
Cyclora subulata (Conrad)																																																																																		
Holopea obsoleta (Hall)																																																																																		
Strophostylus cancellatus (Hall)																																																																																		
S. ventricosus (Hall)																																																																																		
Diaphorostoma hemisphericum (Hall)																																																																																		
D. niagarense (Hall)																																																																																		
Platyceras angulatum (Hall)																																																																																		
P. niagarense (Hall)																																																																																		
Tentaculites minutus Hall																																																																																		
Cornulites distans Hall																																																																																		
C. flexuosus (Hall)																																																																																		
Conularia longa Hall																																																																																		
C. niagarensis Hall																																																																																		
CEPHALOPODA																																																																																		
Orthoceras ? abruptum Hall																																																																																		
O. bassleri Prouty																																																																																		
O. ? clavatum Hall																																																																																		

Table 3 Faunal tables

FAUNAL TABLES

Species	UPPER CLINTON: ROCHESTER: Niagara G.	ROCHESTER: Lockport	ROCHESTER: Densmore G.	ROCHESTER: Salmon C.W.	ROCHESTER: Mink C.	ROCHESTER: Salmon C.E.	ROCHESTER: Second C.	ROCHESTER: Sodus C.	ROCHESTER: Beaver C.	ROCHESTER: Wolcott C.	ROCHESTER: L. Wolcott C.	ROCHESTER: Blind Sodus C.	ROCHESTER: L. Sodus C.	ROCHESTER: Oneida Lake	HERK.: Stony C.	HERK.: College Hill G.	HERK.: Dawes Quarry G.	HERK.: Willowvale	KIRK.: College Hill G.	KIRK.: Dawes Quarry C.	KIRK.: Willowvale	IRONDEQUOIT: Niagara G.	IRONDEQUOIT: Lockport	IRONDEQUOIT: Genesee G.	IRONDEQUOIT: Salmon C.W.	IRONDEQUOIT: Second C.	IRONDEQUOIT: Beaver C.	IRONDEQUOIT: L. Wolcott C.	IRONDEQUOIT: Blind Sodus C.	WILLIAMSON: Genesee G.	WILLIAMSON: Salmon C.W.	WILLIAMSON: Second C.	WILLIAMSON: L. Wolcott C.	WILLIAMSON: Phoenix	WILLIAMSON: Brewerton	WIL.: Dawes Quarry C.	WIL.: Willowvale	W: Dawes Quarry C.	M. SAU: Stony C.	M. SAU: Willowvale	LOWER CLINTON: W.F.: Second C.	W.F.: Stony C.	WOLCOTT: Fish C.	WOLCOTT: Salmon C.W.	WOLCOTT: Second C.	WOLCOTT: Mudge C.	WOLCOTT: L. Wolcott C.	UPPER SODUS: Fish C.	UPPER SODUS: Salmon C.E.	UPPER SODUS: Second C.	UPPER SODUS: Mudge C.	UPPER SODUS: L. Wolcott C.	UPPER SODUS: L. Sodus C.	UPPER SODUS: Sterling Valley C.	UPPER SODUS: Stony C.	L. SODUS: Genesee G.	L. SODUS: Salmon C.E.	L. SODUS: Beor C.	L. SODUS: Mortville	REYNALES: Niagara G.	REYNALES: Lockport	REYNALES: Johnson C.	REYNALES: Genesee G.	REYNALES: Densmore G.	REYNALES: Glen Edyth	REYNALES: Fruitland	REYNALES: Weed C.	REYNALES: Mink C.	REYNALES: Salmon C.E.	B. CR.: Beor C.	B. CR.: Sterling Station	B. CR.: Mortville	FURNACEVILLE: Genesee G.	FURNACEVILLE: Densmore G.	FURNACEVILLE: Fruitland	FURNACEVILLE: Weed C.	FURNACEVILLE: Mink C.	FURNACEVILLE: Salmon C.E.	FURNACEVILLE: Beor C.	FURNACEVILLE: Sterling Station	FURNACEVILLE: Mortville	M: Densmore G.	N: Niagara G.
O. virulatum Hall																																																																																		
Dawsonoceras annulatum (Sowerby)																																																																																		
Kionoceras cancellatum (Hall)																																																																																		
Discosorus conoideus Hall																																																																																		
Actinoceras vertebratum (Hall)																																																																																		
Cyrtoceras subcancellatum Hall																																																																																		
Oncoceras subrectum Hall																																																																																		
ARTHROPODA																																																																																		
TRILOBITA																																																																																		
Bumastus ioxus (Hall)																																																																																		
Goldius niagarensis (Hall)																																																																																		
Proetus corycoeus (Conrad)																																																																																		
P. stokesi (Murchison?) Hall																																																																																		
Arctinurus nereus (Hall)																																																																																		
Encrinurus ornatus Hall & Whitfield																																																																																		
Calymene clintoni (Vanuxem)																																																																																		
C. cresapensis Prouty																																																																																		
C. niagarensis Hall																																																																																		
C. senaria Conrad																																																																																		
Calymenella rastrata (Vogdes)																																																																																		
Homalonotus delphinocephalus (Green)																																																																																		
Cheirurus niagarensis (Hall)																																																																																		
Dalmanites limulurus (Green)																																																																																		
Phacops trisulcatus (Hall)																																																																																		
OSTRACODA																																																																																		
Chilobolbina hartfordensis Ulrich & Bassler																																																																																		
Paraechmina spinosa (Hall)																																																																																		
P. postica Ulrich & Bassler																																																																																		
Zygobolba curta Ulrich & Bassler																																																																																		
Z. decora (Billings)																																																																																		
Z. elongata? Ulrich & Bassler																																																																																		
Z. excavata Ulrich & Bassler																																																																																		
Z. inflata Ulrich & Bassler																																																																																		
Z. intermedia Ulrich & Bassler																																																																																		
Z. oblonga Ulrich & Bassler																																																																																		
Z. prolixa Ulrich & Bassler																																																																																		
Z. rectangula Ulrich & Bassler																																																																																		
Z. robusta Ulrich & Bassler																																																																																		
Zygobolbina conradi Ulrich & Bassler																																																																																		
Mastigobolbina clarkei Ulrich & Bassler																																																																																		
M. incipiens Ulrich & Bassler																																																																																		
M. lata (Hall)																																																																																		
M. lata var nana Ulrich & Bassler																																																																																		
M. punctata Ulrich & Bassler																																																																																		
M. retifera Ulrich & Bassler																																																																																		
M. trilobata Ulrich & Bassler																																																																																		
M. typus Ulrich & Bassler																																																																																		
M. vanuxemi Ulrich & Bassler																																																																																		
Plethobolbina typicalis Ulrich & Bassler																																																																																		
Dizygopleura intermedia cornuta Ulrich & Bassler																																																																																		
D. proutyi Ulrich & Bassler																																																																																		
Beyrichia aff. lakemontensis																																																																																		
B. hartnageli Ulrich & Bassler																																																																																		
B. veronica Ulrich & Bassler																																																																																		
Dibolbina n. sp.																																																																																		

= rare
= common
= abundant

Table 3 Faunal tables

stones, sandstones and iron ores and thus seem to have been able to live and be preserved under a greater variety of conditions than any other class of organisms living in the Clinton seas. In fact there are only three formations, the Thorold and the Maplewood of western New York and the thin cross-bedded Dawes sandstone at Clinton (section 33, p. 169), which have not yielded ostracods. If they are not in the limestone layers, they will be in the thin shale breaks between the layers. If they are not in one type of shale, they will be in an adjacent shale of slightly different character. A thorough search never fails to reveal them. In the limestone layers the original shells are often preserved. In the shale layers they usually are present as natural internal casts. In the weathered sandstones they are most often represented as external molds. The only handicap ostracods have is their small size which makes them difficult if not impossible to accurately determine in the field.

Five ostracod zones can be recognized in the Clinton of New York State, two each in the Upper and Lower Clinton and a single zone in the Middle Clinton. These zones are:

Upper Clinton
- *Paraechmina spinosa* zone
- *Mastigobolbina typus* zone

Middle Clinton
- *Mastigobolbina lata* zone

Lower Clinton
- *Zygobolba decora* zone
- *Zygobolba excavata* zone

Ulrich and Bassler ('23, p. 349–52, 372–91) were the first to suggest using ostracods as a basis for correlating and subdividing the Clinton. They recognized the following zones:

Upper Clinton
- 9 *Drepanellina clarki* zone
- 8 *Mastigobolbina typus* zone
- 7 *Bonnemaia rudis* zone

Middle Clinton
- 6 *Zygosella postica* zone
- 5 *Mastigobolbina lata* zone
- 4 *Zygobolbina emaciata* zone

Lower Clinton
- 3 *Zygobolba decora* zone
- 2 *Zygobolba anticostiensis* zone
- 1 *Zygobolba erecta* zone

The *M. typus, M. lata* and *Z. decora* zones of this publication correspond exactly to the zones which Ulrich and Bassler recognized not only in New York but in Anticosti, Pennsylvania, Maryland and other states in the Appalachian Valley region. The *Z. excavata* zone

TABLE 4

CLINTON OSTRACOD ZONES

	NIAGARA COUNTY		MONROE COUNTY		WAYNE COUNTY		ONEIDA COUNTY	
UPPER	PARAECHMINA SPINOSA ZONE	ROCHESTER	PARAECHMINA SPINOSA ZONE	ROCHESTER	PARAECHMINA SPINOSA ZONE	ROCHESTER	PARAECHMINA SPINOSA ZONE	HERKIMER KIRKLAND
	MASTIGOBOLBINA TYPUS ZONE	IRONDEQUOIT	MASTIGOBOLBINA TYPUS ZONE	IRONDEQUOIT WILLIAMSON	MASTIGOBOLBINA TYPUS ZONE	IRONDEQUOIT WILLIAMSON	MASTIGOBOLBINA TYPUS ZONE	WILLOWVALE WESTMORELAND
MIDDLE							MASTIGOBOLBINA LATA ZONE,	SAUQUOIT ONEIDA
LOWER					ZYGOBOLBA DECORA ZONE	WOLCOTT UPPER SODUS	ZYGOBOLBA DECORA ZONE	ONEIDA
	ZYGOBOLBA EXCAVATA ZONE	REYNALES NEAHGA	ZYGOBOLBA EXCAVATA ZONE	LOWER SODUS REYNALES FURNACEVILLE	ZYGOBOLBA EXCAVATA ZONE	LOWER SODUS REYNALES FURNACEVILLE		

Table 4 Clinton ostracod zones

probably corresponds to their *Z. anticostiensis* zone. Most of the forms which are associated with *Z. anticostiensis* in Maryland and Anticosti have been found in New York, but *Z. anticostiensis* itself has not been identified from this State. To avoid any possible misunderstanding and confusion the zone is designated as *Z. excavata.* In a similar manner the forms allied with *Drepanellina clarki* in Pennsylvania and Maryland (F. M. Swartz, '34, p. 81–134 and '35, p. 1165–194) are found in New York State, but *D. clarki* itself has never been collected or identified from this area. For this reason the zone is therefore called *Paraechmina spinosa.*

In table 4, page 23 the occurrence of the five ostracod zones in Niagara, Monroe, Wayne and Oneida counties is summarized. The table also shows the formations in which ostracods are known to occur. The details concerning the presence of ostracods will be discussed later in connection with each separate formation.

DETAILED STRATIGRAPHIC AND PALEONTOLOGIC RELATIONS

LOWER CLINTON

Thorold Sandstone

Definition. The Thorold quartzite (gray band of earlier reports, see p. 9) was named from an exposure at Thorold, Ontario (Grabau, '13, p. 460). At the type locality the formation is a quartzite (see Williams, '19, p. 25) but everywhere in New York and in most places in Ontario it is a sandstone. Consequently the formation has become more fittingly designated as the Thorold sandstone.

Extent and lithologic characteristics. The Thorold in the Niagara gorge is a light gray, fine-grained resistant sandstone. Its resistant character makes it stand out as an easily recognizable unit. The formation is six feet thick. The upper three and one-half to four feet is a single massive bed. The lower part is thin-bedded and in places cross-bedded. The sandstone is very fine grained. The individual quartz grains range from silt to very fine sand according to the Wentworth scale. The sand grains are not well-rounded and range from angular to semiangular. The formation is highly but not uniformly argillaceous throughout, the upper massive portion appearing to be more argillaceous than the underlying thinner cross-bedded part. At Niagara the argillaceous material is confined to the matrix of the sandstone layer. Only two or three thin shale breaks were observed between the sandstone layers. The cementing material is both siliceous and calcareous with silica having the dominating

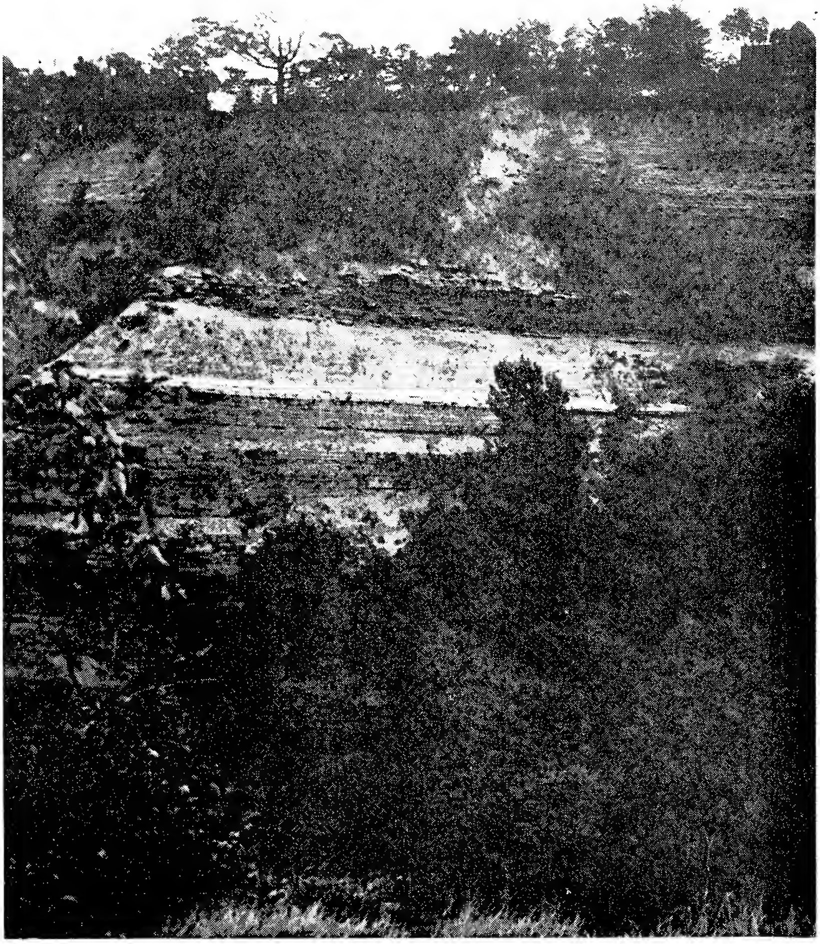

Figure 3 Genesee gorge. Note gray resistant Thorold which overlies the red Grimsby sandstone and underlies the green Maplewood shale

role. The small grain size, the angularity, the argillaceous content and the degree of cementing have all contributed to produce a dense, compact sandstone. Even weathered samples show little porosity and less permeability.

Microscopic analysis of the Thorold by Alling ('36, p. 196) shows the Thorold to consist of 70 per cent quartz, 6 per cent feldspar and 20 per cent argillaceous material. The argillaceous material includes "chlorite, muscovite, rusty biotite and uralite." The accessory minerals make up about 4 per cent of the rock. They include according to Alling "grains of calcite, calcite as a cement, opaline silica, ilmenite with attendant leucoxene, chromite, garnet, magnetite, zircon, apatite and tourmaline." Sanford's ('39, p. 77–85) mechanical analysis and insoluble residue studies show the calcareous content of the rock to be approximately 1 per cent.

To the east of the Niagara gorge the Thorold can be traced through the Lockport and Gasport outcrops to the Genesee gorge (figure 3). For a sandstone there is surprisingly little variation in thickness, being six feet at Lockport, six and one-half feet north of Gasport and five feet in the Genesee gorge. At Lockport the massive character of the Thorold of the Niagara gorge is retained. A single layer was observed measuring over three feet in thickness. From Lockport eastward the formation is better stratified and there is very little cross-bedding. As the layers become thinner and more abundant, green silty shales are found separating the thicker sandstone layers. As a whole the formation retains its dense, compact character which together with its light gray color sets it off from the underlying Grimsby. It possesses the same resistance to erosion which explains its position as cap rock for the lower falls of the Genesee river.

A study of the microlithology of the Thorold between the Niagara gorge and Rochester reveals that the only appreciable change that has taken place is in the thin shale breaks, mentioned in the foregoing paragraph. As far east as Lockport fine silty quartz is the dominant constituent of the shale layers with the argillaceous material forming less than 50 per cent of the rock. To the east in Monroe county true argillaceous shales are more abundant. Even in the Genesee gorge the shale breaks, however, contain a high percentage of quartz. It seems, as Alling ('36, p. 192) has pointed out, that the development of shaly structure can be caused by a surprisingly small amount of clay minerals.

The Thorold can be traced with no great difficulty eastward from the Genesee gorge to western Cayuga county. This is largely due to the fact that the formation retains its characteristic light gray color and its fine angular quartz groundmass. The formation ranges from

less than four feet to six feet. The argillaceous content of the sandstone layers increases. Furthermore true argillaceous green shales are common and some attain a thickness of two inches. In addition flattened green clay pellets are seen embedded in the sandstone layers. These pellets, which are discussed at some length in a previous publication (Gillette, '40, p. 40–43), are always either parallel or nearly parallel to the bedding planes. The sandstone becomes more calcareous, and with the increase in calcium carbonate it is less resistant and more friable. In Wayne county the contact of the Grimsby and the Thorold is not so sharp as it is to the west and in places the two are actually seen grading into each other.

There is considerable change in the Thorold sandstone in crossing the relatively narrow northern part of Cayuga county. In western Cayuga county the Thorold is approximately five and one-half feet thick. In extreme eastern Oswego county at Lunn's quarry between Martville and Hannibal, only four miles distant in a direct line, the formation increases to seven and one-half feet. The upper two and one-half feet is coarser than the Thorold of western New York and ranges according to the Wentworth scale from fine to medium. It contains dark gray, phosphatic sandstones interbedded with the typical light gray layers. Immediately underlying this portion is a conglomerate which varies from less than an inch to more than six inches in thickness. The conglomerate contains pebbles up to a centimeter in diameter. The remaining portion of the Thorold consists of fine-grained silty sandstone which is similar to the Thorold of western Cayuga and Wayne counties.

The contact of the Thorold with the underlying Grimsby is gradational and in this respect also is like the Thorold of western Cayuga and Wayne counties. The upper contact however is quite different. To the west the overlying formations usually show an increase in the amount of sand as the contact is approached, but there is no interbedding of sandstone with the overlying shales, limestones or iron ores. At Lunn's quarry there is a very definite thin transition zone in which shales and stringers of iron ore are found interbedded with sandstones. The sandstones are similar to the underlying Thorold in color and composition. The dark gray to green shales are like the overlying Bear Creek in lithology and fossil content.

The next outcrop is located only about six miles east at Fulton. The rocks occupying the stratigraphic position of the Thorold, are conglomeratic and are considered the westernmost outcrop of the Oneida conglomerate.

Fauna. For the most part the Thorold contains very few fossils. *Arthrophycus alleghaniensis* is by far the most common fossil and is

best seen in the weathered sandstones. At Lunn's quarry near Martville (section 25) the shales interbedded with sandstones in the transition zone contain fossils common or restricted to the *Zygobolba excavata* zone of the Lower Clinton. The most common forms are the brachiopods, *Lingula clintoni* and *L. perovata* and the ostracods, *Zygobolba prolixa* and *Z. curta.*

Age and origin. There has been considerable discussion concerning the age of the Thorold sandstone. Many geologists (table 1, p. 10 and 11) have considered it as Albion in age. Others have thought it more closely related with the overlying Clinton. The writer subscribes to this latter view. The finding of definite Clinton ostracods in the Thorold of Lunn's quarry (section 25, p. 160) and the lateral gradation of the Thorold into the Oneida conglomerate which also yields a Clinton fauna would seem to make this formation Clinton beyond reasonable doubt.

The Thorold was evidently laid down as the initial deposit in the Lower Clinton sea whose marine waters spread out and covered the low geosynclinal area of which western New York was a part. The fine character of the sediments is evidence that this formation was deposited far from any high land mass or source of coarse clastics. Alling ('36, p. 196) has given some petrographic evidence pointing to the conclusion that the Thorold may have been derived from the underlying Grimsby. The lack of any definite line of separation between the Thorold and the Grimsby in some areas (p. 28) is in agreement with this contention. It is reasonable to expect that the sea would rework the upper layers of the underlying recently deposited sandstones of the preceding Albion group.

The similarity in the character of the sediments of the Thorold and the Grimsby may be due on the other hand to the fact that these two formations derived their clastics from the same source. Proof exists that a high land mass lay to the east in both Albion and Lower Clinton times (p. 34). The fact that the Oneida interfingers with the Thorold would tend to show that some of the finer clastics must have been carried into the sea along with the coarser material.

In summary it seems likely that the Thorold formed from eroding, reworking and a redeposition of the previously formed Grimsby with the addition of some fresh clastic material from the east. The reworking could not have taken place *in situ* since in many places the formation is thin-bedded with relatively thick and undisturbed shale partings. The amount of new clastics added was probably very significant east of Wayne county but was of little importance to the west.

Oneida Conglomerate

Definition. The Oneida conglomerate was named by Vanuxem ('42, p. 75) "from well-defined exposures in Oneida county." This formation and the Rochester shale bear the distinction of being the only two subdivisions of the Clinton group which were named and established as distinct units by the first New York State Geological Survey and which are still used.

Extent and lithologic characteristics. The westernmost outcrop of the Oneida conglomerate is on Oswego river at Fulton. It is located only eleven miles east of the Thorold outcrop near Martville, but in this distance the Thorold has changed to the Oneida and the basal deposit of the Clinton has almost doubled its thickness, and measures about 12 feet. The massive conglomerates typical of the Oneida are interbedded with light gray sandstones. Most of the conglomerates are tightly cemented with silica. The cementation is so complete and thorough that the rock breaks across the pebbles rather than around them. One of these resistant conglomerates forms the cap rock for the falls at Fulton. Most of the sandstone layers are coarser than the Thorold of western New York. One layer three feet from the base, however, showed sand ranging from fine to very fine and also contained clay pellets like those observed in western Cayuga county.

The upper contact of the Oneida conglomerate with the overlying formations is not exposed. The basal contact with the Grimsby is sharp and because of the cross-bedded nature of the upper layers of the Grimsby at Fulton it is spectacular (see figure 4, p. 31).

Between Fulton and Oneida lake there are few outcrops of this formation but east of the lake in the town of Verona there are a number of good exposures. In this area the Oneida consists of white to light gray conglomerates with interbedded coarse sandstone. The typical conglomeratic layers are made up of poorly sorted material usually varying from coarse sand to pebbles a half inch in diameter. The largest pebble found measured two and one-quarter inches in diameter. Both the pebbles and the coarse sand are well-rounded. The cementing matrix is silica and the cementation has been so complete through the introduction of this secondary silica that there is very little porosity. These very resistant conglomeratic layers are often found as ledges in the fields and form small escarpments which can be traced for a considerable distance. The top of some of the massive layers shows glacial polish and striae. The sandstone layers, like the conglomeratic, are poorly sorted. The grains vary from coarse to fine. The coarse grains are more abundant than the fine.

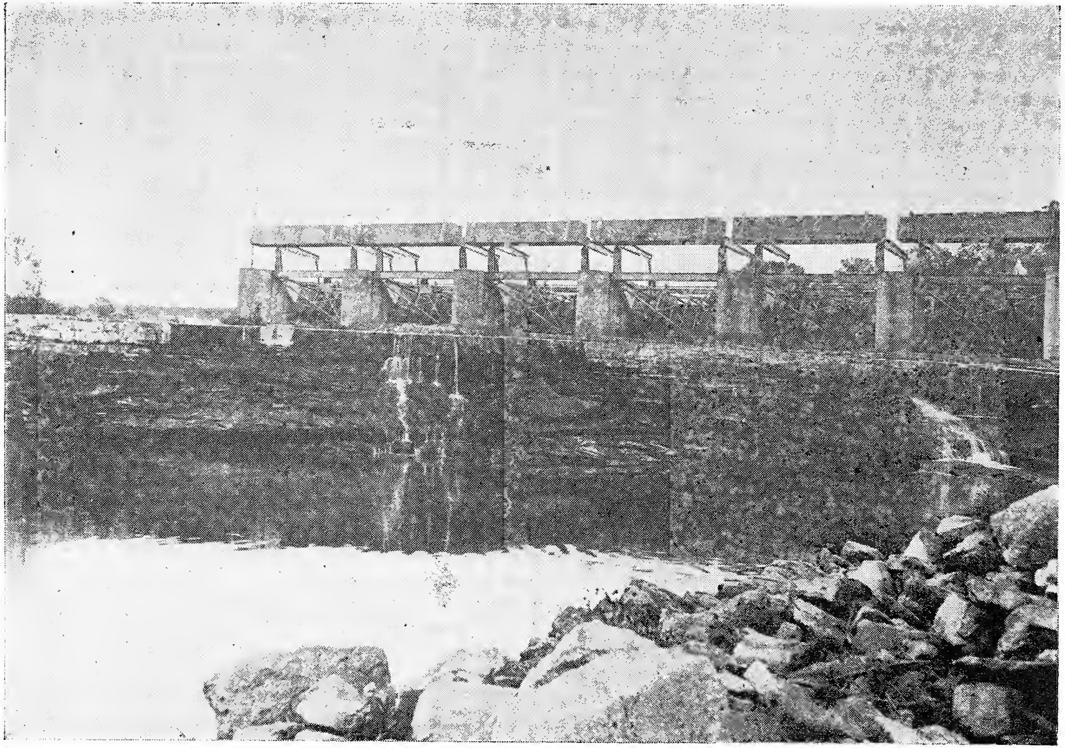

Figure 4 Fulton, New York. Contact of Oneida and Grimsby

Figure 5 Quarry in the Oneida conglomerate east of Willowvale

The process of cementation was not so complete in these layers as in the conglomerate. Some outcrop specimens are even friable and show a much higher degree of porosity than in either the Thorold of western New York or the conglomeratic layers of the Oneida in central New York. They are less resistant. Shale layers are almost entirely lacking in the lower part of the Oneida conglomerate, but in the upper third and particularly near the contact with the overlying Upper Sodus thin, silty shales are abundant.

The Oneida conglomerate continues east beyond the limits covered by this report. It attains a maximum known thickness of about 30 feet near Willowvale (figure 5). Others have reported as much as 70 feet but the writer could find no such thickness. In the area east of Oneida lake the Oneida retains the same lithologic characteristics.

The exact contact of the Oneida with the underlying formation is not exposed east of Fulton within the area covered by this report. Vanuxem ('42, p. 75–78) and more recently Hartnagel ('07, p. 27–37) have shown that the Oneida overlaps increasingly older formations to the east. The upper contact of the Oneida is gradational. At Verona it interfingers with the Upper Sodus shale. At Willowvale the upper layers are interbedded with shale similar to the Sauquoit in lithology and fossil content. At Verona the transition zone is estimated to be about five feet thick. At Willowvale (section 34, p. 171) conglomeratic layers are found more than 20 feet above the massive Oneida.

Fauna. The conglomeratic layers of the Oneida rarely contain *Arthrophycus alleghaniensis.* It is more common in the sandstone layers. This fossil is particularly abundant at Verona and at Fulton. The thin, silty shales of the upper part of the Oneida yield some fossils. At Verona (section 31, p. 164) they contain fossils restricted or common to the *Zygobolba decora* zone of the Lower Clinton. The brachiopods, *Coelospira hemispherica* and *Stropheodonta corrugata,* and the ostracod, *Z. decora,* are the most characteristic fossils. At Willowvale (section 34, p. 171) these shales are rich in pelecypods and contain many trilobites, particularly *Liocalymene clintoni.* The ostracods, *Mastigobolbina lata, M. vanuxemi* and *Zygobolbina conradi,* are also very abundant in these layers. All the fossils found are related or common to the *M. lata* zone of the Middle Clinton.

Age and origin. Vanuxem ('42, p. 75–78) in his original survey considered the Oneida as Clinton in age. The fact, that the Oneida overlaps formations varying from the Lower Silurian to Ordovician, and that it is closely associated by transition zones with the overlying shales (see above), is proof in itself that the Oneida is in part Clinton.

The finding of Clinton ostracods in the shale breaks in the upper part of the Oneida at various places should remove any remaining doubt.

The Oneida apparently originated as a basal conglomerate while the Clinton seas were gradually working their way eastward and encroaching upon the high land mass which lay in that direction. Some of the material comprising the Oneida probably collected as rubble and shingle at the margin of this ancient land area and was later picked up and worn smooth by current and wave action. The actual pebbles may have been carried long distances along the old shore line before reaching their present locations. The similarity in the composition of the Oneida and the Shawangunk conglomerates suggests that these may have had the same ultimate source. The greater thickness of the Shawangunk of southeastern New York may indicate that the source lay to the southeast rather than east. Even if this were true, some clastics probably were derived from the rock which formed the beach to the immediate east of the present area of the Oneida conglomerate.

Certainly the land mass which furnished the clastics was the controlling factor in the formation of the Oneida conglomerate. As long as it remained a high land mass accessible to the forces of erosion, the products of which were within reach of the sea, the Oneida conglomerate continued to form. Only when it was worn down did the Oneida sedimentation come to a close. That the Oneida formed throughout the Lower and Middle Clinton is indicated by the fossils found in the thin shale partings in the upper part. Ostracods of the *Zygobolba excavata* zone were found near Martville only six miles west of the true Oneida type of lithology. The fossils of the *Z. decora* zone were found at Verona and the assemblage of the *Mastigobolbina lata* zone at Willowvale. From this evidence it is apparent that the shore line was migrating eastward throughout the deposition of the Oneida.

A precursory examination of the Oneida conglomerate failed to reveal any appreciable differences in the strata of various ages. A careful petrographic study of the conglomeratic and sandy layers, however, might throw some light on the actual source rocks. Such a study should also include the Shawangunk and similar conglomerates such as the Green Pond in southeastern New York and Pennsylvania.

Neahga Shale

Definition. The Neahga shale was named by Sanford ('35, p. 170–74) from an outcrop in the Niagara gorge. It had previously been called the "Lower Green Shale" by Hall ('43, p. 59); the Clinton

shale by Grabau ('01, p. 96); the Sodus shale by Kindle and Taylor ('13); and the Furnaceville shale by Williams ('19, p. 47–48).

Extent and lithologic characteristics. The only good exposure of the Neahga shale is at its type locality in the Niagara gorge. At that place the formation is approximately six feet thick. The upper five to five and one-half feet consists of a smooth, slightly silty, slightly calcareous, green platy shale.

The typical Neahga grades downward into a silty, sandy, calcareous green shale. Although this portion of the formation is quite different from the typical smooth platy Neahga, it does not seem to justify a new formation name. It still has a shaly structure in the outcrop and any division would have to be arbitrary. There is no distinct contact.

In some respects this green, sandy part of the Neahga can be considered a transition zone between the Thorold below and the smooth platy Neahga above. Some of the thin layers are, as Alling ('36, p. 196) has pointed out, calcareous, argillaceous sandstones, whereas others approach the smooth, platy character of the Neahga. On the other hand both parts of the formation have the same green color and except for a few thin layers even the most sandy ones contain enough argillaceous material to preserve a shaly structure.

The Neahga shale thins both to the east and west of the Niagara gorge. To the west its only observed occurrence in Ontario is at DeCew falls where according to Williams ('19, p. 48) a green shale a few inches thick occupies the stratigraphic position of the Neahga. At Lockport there is no typical smooth platy Neahga, but about eight inches of green, silty, sandy shale similar in many respects to the lower part of the Neahga of the Niagara gorge is found between the Reynales and the Thorold.

Fauna. The fossils of the Neahga are few in number and poorly preserved. The *Coelospira* are the most common brachiopods. Sanford ('35, p. 170–74) believes that the *Coelospira* of the Neahga are different from those of the higher Clinton formations. According to the writer's observation there are possibly two *Coelospira* in the formation. One can not be distinguished from the typical *Coelospira hemispherica* and the other is probably *Coelospira plicatula* of Grabau ('01, p. 96). The fossils, however, are so poorly preserved that they do not lend themselves to minute differentiation. The pelecypods, *Pterinea emacerata* and *Cuneamya alveata,* are relatively abundant. *Holopea obselata* and *Tentaculites minutus* are also present. Some poorly preserved ostracods are also found. The two species, *Zygobolba excavata* and *Z. curta,* have been definitely identified from the formation.

Origin. The origin of the Neahga was probably closely allied to the Maplewood and will be discussed with that formation (see p. 37).

Maplewood Shale

Definition. The Maplewood shale was named by Chadwick ('18, p. 34) from an exposure in the Genesee gorge near Maplewood park. The shale at that place had previously been called "Lower Green Shale" by Hall ('43, p. 59) and the Sodus shale by Hartnagel ('07, p. 13–14).

Extent and lithologic characteristics. The Maplewood shale of the Genesee gorge closely resembles the Neahga of the Niagara gorge in lithology. It is the same smooth, slightly calcareous, green, platy shale.

The lower three feet, also resembling the lower part of the Neahga, is sandy and much more calcareous. Unlike the Neahga this portion of the Maplewood does not contain any thin sandstone layers. The sandy content increases gradually although not uniformly downward to the contact of the Thorold. At this contact silt to very fine sand makes up over 50 per cent of the matrix. An abundance of phosphatic nodules is characteristic of this lower Maplewood in Monroe county.

The Maplewood has a limited lateral extent confined, so far as known, to Monroe county. The thickness is extremely variable. The known maximum thickness of 21 feet is exposed in the Genesee gorge (section 5, p. 127). On Densmore creek (section 6, p. 131) only three and one-half miles to the east it can not exceed 18 feet. At Glen Edythe (section 7, p. 133) five and one-quarter miles from the gorge on the east side of Irondequoit Bay, it is about 15 feet thick. Near Fruitland only fourteen and one-half miles from the type locality the Furnaceville is separated from the Thorold by only three or four inches of green, silty and sandy, calcareous shale. Typical Maplewood is entirely missing. From Fruitland eastward nothing approaching the Maplewood or Neahga appears in the outcrops. At a few places silty, green shales do separate the Furnaceville and the Thorold as on Salmon creek (section 13, p. 140); also see (Gillette '40, p. 43–44). At no place were these shales found to exceed eight inches and usually they are much less. Furthermore their color is their only resemblance to the Neahga or Maplewood. They are usually fissile instead of platy and very fossiliferous in contrast with the almost barren Maplewood. At most localities these shales contain scattered oolites of hematite.

The stratigraphic position of the Neahga and Maplewood is the same. The lithologic character is similar. Both are equally variable in thickness. Both are only sparingly fossiliferous. In view of all

these similarities the advisability of continuing both names might be questioned. The Neahga, however, is confined to a limited area in Niagara county. The nearest outcrops are over 60 miles apart. A correlation is certainly implied, but it seems best to retain both names for local usage.

South of the line of outcrop several wells put down in search of gas discovered another occurrence of a smooth, platy, green shale occupying the stratigraphic position of the Maplewood and the Neahga. At Clyde in southern Wayne county a green shale was present, probably about two feet thick. In northeastern Ontario county five and one-half miles south of Clyde ten feet of green shale overlies the Thorold. Farther south in the now defunct Geneva gas field three wells which penetrated the Clinton, failed to show even a trace of green shale. From this it can be inferred that the green shale of northeastern Ontario county has the same variable thickness as the Neahga and the Maplewood.

Fauna. Fossils are rare in the Maplewood. Most of the few poorly preserved forms which were collected, came from the lower three feet of the formation. Several *Coelospira,* probably *hemispherica,* were found. The gastropod, *Holopea obsoleta,* is by far the most common fossil. Although the formation was carefully investigated no ostracods were located.

Origin. The origin of these variable green shales is certainly baffling. It is possible that a shale body once extended unbroken from Niagara county at least as far east as Wayne county and that it was scoured and eroded away before the Reynales was deposited. As already pointed out, the Maplewood and Neahga show a gradation with the underlying Thorold. Where neither the Maplewood nor the Neahga is present the Thorold shows no such gradation with the overlying formations. The upper limit of both of these shales is always sharp, and there is no apparent mingling. This evidence might be taken as showing that there was a complete withdrawal of the sea with an ensuing period of erosion.

There is another and to the writer a more plausible explanation. As previously mentioned the Thorold has an abundance of green, silty shale breaks and included green shale pellets. The color and lithology both megascopic and microscopic show great resemblance to the Maplewood. With the deposition of the Thorold the clastic material was evidently exhausted. The Maplewood may represent a relatively quiet area into which the currents and waves swept the light clay particles during the last stages of Thorold deposition. Such an

explanation would eliminate any necessity for the complete removal of the sea and for subaerial erosion.

Sanford ('35, p. 1070–74) has suggested that these formations were deposited in bays. The objection to this idea is that a bay by definition is land locked, and there is no evidence of a near-by land mass. The Thorold has a remarkably uniform thickness throughout both Niagara and Monroe counties. If such a thin formation has been subjected to the normal agents of erosion so soon after its deposition, it could not conceivably have preserved this uniformity of thickness.

Furnaceville Iron Ore

Definition. The Furnaceville iron ore was introduced as a formational name for the oolitic or lenticular iron ore of Hall ('43, p. 60–62) by Hartnagel ('07, p. 14). The term was derived from an occurrence in the old ore pits near Furnaceville in western Wayne county. Sanford ('35, p. 167–83) pointing out that the Furnaceville is always closely associated with the Reynales suggested making the Furnaceville a member of the Reynales limestone.

In the Genesee gorge the Furnaceville is underlain by three feet of rather typical basal Reynales and overlain by the *Pentamerus* portion of the same formation. This condition holds for only a short distance to the east where the hematitic limestone appears to gradually fade into a true limestone. A few miles farther to the east the Furnaceville is again found, but it occupies a position at the base of the Reynales.

There are two possible explanations for such a relationship. The lower part of the Reynales, as will be shown later, contains considerable iron, sometimes as pyrite, sometimes as thin stringers of hematite. The iron ore of the Genesee gorge may represent a concentration of hematite which is later than that of the Furnaceville farther to the east. The other possible explanation is that while the Furnaceville was slowly forming to the east the lower Reynales was being deposited in the vicinity of Rochester and to the west. A slight change in conditions near the close of the Furnaceville could bring about the concentration of hematite in the gorge area. The thickness of this lentil is never great and with the exception of the one outcrop in the Genesee gorge the hematitic content is always low. In spite of a great deal of work on the fossils, lithology and field relationships the writer does not feel in a position to choose which of the two explanations is the more logical. If the former is accepted, then the iron ore in the gorge is younger than that at Fruitland and possibly deserves a separate designation.

The Furnaceville constitutes a lithologic unit easily recognizable and mappable. It can be traced for a long distance and with more

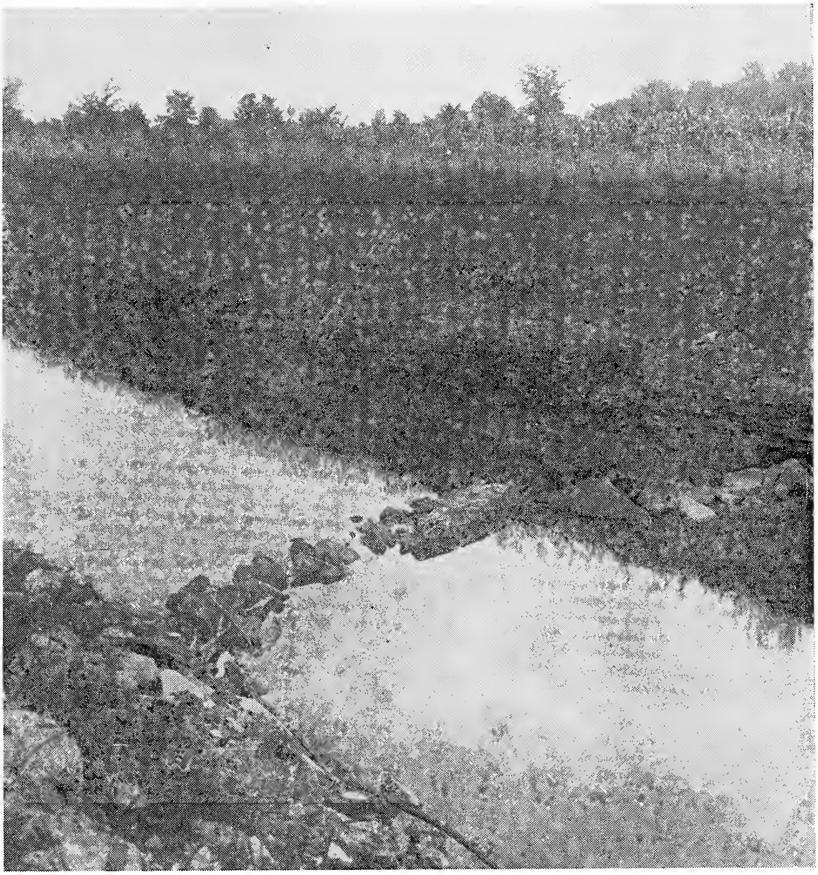

Figure 6 An ore pit near Fruitland, New York

assurance than most Clinton formations. For these reasons it seems preferable to use it as a formational name, to designate the lowermost hematitic limestone of the Clinton group. The Genesee gorge lentil because of its position and similar lithology is considered a part of the Furnaceville iron ore.

Extent and lithologic characteristics. The Furnaceville is a thin, highly variable, hematitic limestone. The variation in hematitic content is easily noted from outcrop to outcrop. In a single section the iron content is quite often found to be different for each layer. Locally there are exceptions, and the more uniform and richer areas of the Furnaceville, where the overburden of rock and till is not too great, have been utilized at one time or another as a source of iron oxide for more than a century. (See figure 6, p. 39.)

The variation in hematitic content of the Furnaceville is largely the result of foreign matter in the ore body. Thin shale breaks and layers of nonhematitic-bearing limestone serve to reduce the concentration of iron. There are other iron bearing minerals present in the Furnaceville, but they are relatively unimportant. They have never been found in any locality in such quantities even to suggest that their presence could in any way account for the iron which in other localities had gone into the formation of hematite.

Taken as a whole, the Furnaceville is dominately a fossiliferous ore, the hematite having replaced brachiopods, bryozoans, crinoids, ostracods etc. The small spherical or slightly flattened spherical, beadlike bodies, called oolites, however, are always found mingling with the replaced fossils. In some outcrops such as the Genesee gorge (section 5, p. 127) and Fruitland (section 8, p. 134) the oolites are comparatively rare. In others such as at the Devoe and Sterling Station ore pits (section 21 and 22, p. 154–57) the oolitic forms account for more than 50 per cent of the total hematite in some layers.

The degree to which the fossils of the ore have been replaced is also variable. At a few localities only the outer surface of the shell is found to have been replaced. Excellent examples of such can be found near the center of Furnaceville on Densmore creek (section 6, p. 131). The hematite forms only a thin film on both the outer and inner surfaces of the large, well preserved *Stropheodonta*. More commonly the fossils are entirely replaced. In a few localities the process appears to have gone a step beyond, and not only are the fossils completely replaced, but also thin concentric bands of hematite surround the fossils. The writer has counted as many as six layers surrounding a single cylindrical bryozoan. The round and cylindrical fossils are the only ones which show this particular phenomena. Excellent examples occur in the lower part of the Furnaceville at Fruitland.

The Furnaceville can be traced as a formation as far west as western Monroe county. It is represented in the Genesee gorge (section 5, p. 127) by a section fourteen inches thick. To the east on Densmore creek (section 6, p. 131) the hematitic content is considerably less and at Glen Edythe (section 7, p. 133) is entirely absent.

Well records show that the Furnaceville reappears as a hematitic limestone in extreme eastern Monroe county. At the ore pits between Fruitland (section 8, p. 134) and Ontario, it reaches a maximum of 20 inches in thickness with a relatively high iron content. To the east the formations can be traced by means of outcrops (sections 11 and 12, p. 137, 139) to Salmon creek (section 13, p. 140) in the eastern part of the Pultneyville quadrangle. The hematitic content is low in this area and on Salmon creek it is represented by approximately one foot of strata, the upper six inches being a hematitic limestone, the lower being a calcareous shale with interbedded stringers of oolitic hematite.

The outcrops to the east of Salmon creek are less common, but the Furnaceville horizon can be traced by well logs to the Devoe ore pit (section 21, p. 154) which is located on Bear creek a tributary of Black creek. In the old ore pits the formation is about 20 inches thick but the concentration of hematite is noticeably less than in the Fruitland pits. The ore at this place contains a considerable amount of argillaceous material. A short distance eastward in western Cayuga county at Sterling Station (section 23, p. 157) the Furnaceville is 36 inches thick and again has a relatively high iron content. The last known outcrop of the Furnaceville to the east is at Lunn's quarry in Oswego county (section 25, p. 160) a few miles from Sterling Station. There the formation is represented by a very argillaceous, slightly hematitic limestone with argillaceous and calcareous sandstones.

By means of the diamond drill cores which were put down under the direction of Newland and Hartnagel ('08, p. 4) and which were made available to the writer through the courtesy of C. A. Hartnagel, the formation can be traced to the east as far as Lakeport, Madison county (figure 7, p. 43). At South Granby (section E, p. 180) the ore is oolitic with a few fossils. It is only about eight inches thick but shows a high concentration of hematite. At Brewerton (section F, p. 182) the formation is represented by about 15 inches with a high iron content. At Lakeport (section G, p. 183) only about four inches can be assigned to the Furnaceville but it is relatively rich in hematite.

The lower contact of the Furnaceville is sharp and the formation appears quite distinct from any of the rock underlying it. As previously pointed out, it rests on the lower part of the Reynales in the Genesee gorge. To the east of Monroe county the ore in many places

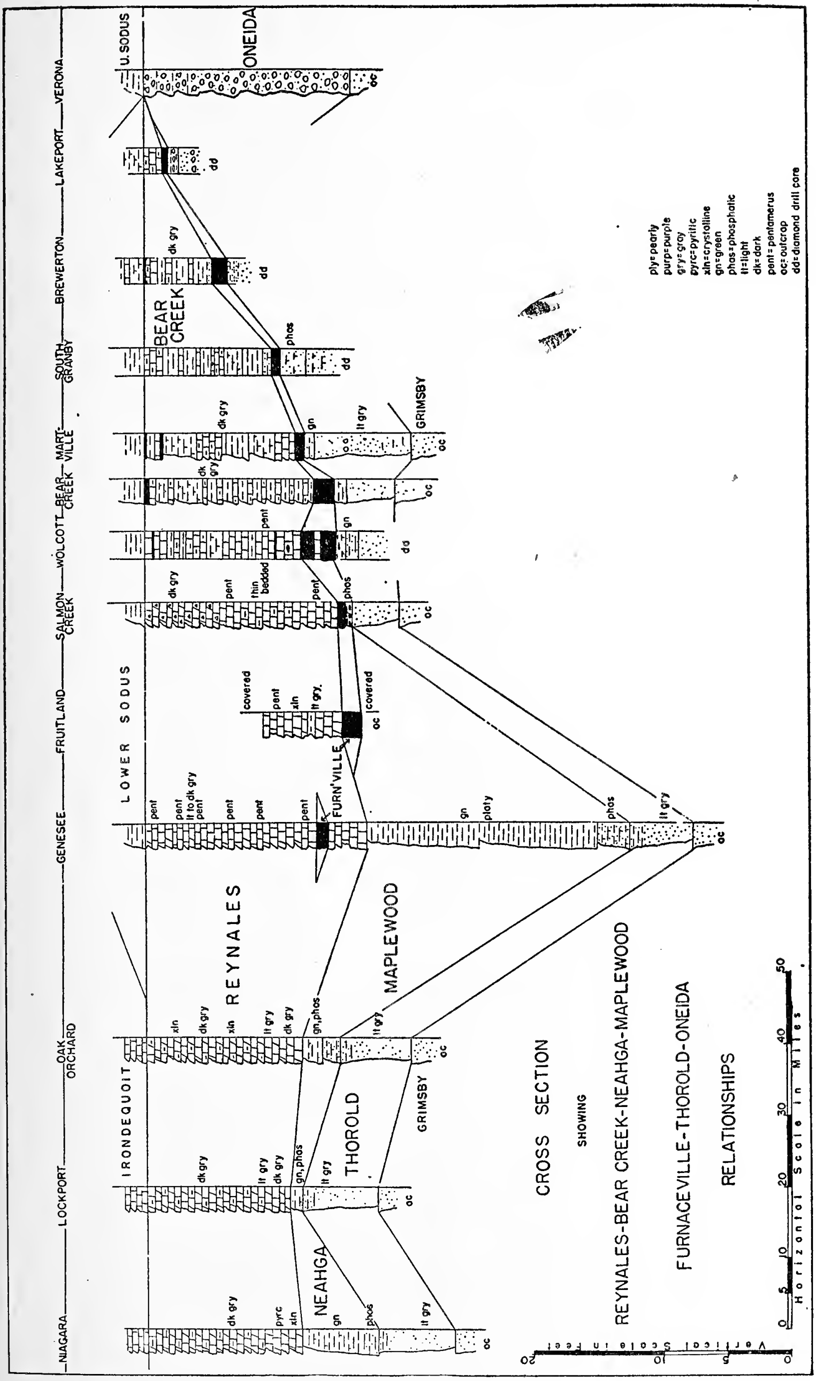

Figure 7 Cross section showing Reynales-Bear Creek-Neahga-Maplewood-Furnaceville-Thorold-Oneida relationships

is in direct contact with the Thorold sandstone. In a few localities it is separated from this basal sand by a few inches of green thinly laminated fossiliferous shale. The thickness of this shale is not known to exceed ten inches.

In the outcrops there is never any difficulty in deciding upon the upper limit of the Furnaceville, but east of Fruitland the lower two and one-half to three feet of Reynales is in many places impregnated with stringers of hematite. This seems to indicate that there was a transition from the hematitic forming conditions to those of the typical Reynales. In eastern Wayne county the Reynales grades laterally into the Bear Creek shale. This shale is in contact with the Reynales as far east as Lakeport where both the Bear Creek and the Furnaceville appear to pinch out against the Oneida conglomerate (figure 7, p. 43).

Fauna. The fauna of the Furnaceville is plentiful and varied. At a few outcrops the fossils are of normal size and well-preserved. More commonly they are poorly preserved and hard to identify specifically. Many of the more fragile fossils were apparently crushed and broken into fragments before they were replaced by hematite. The less fragile ones have the appearance of having been subjected to some form of abrasion, which removed their finer markings. In addition to the normal marine fauna of the Furnaceville some outcropping layers contain dwarf fossils. These dwarf forms are always confined to definite layers. They are similar in every respect except size to those occurring in the overlying or underlying strata.

Except for crinoid stems bryozoans are the most abundant of all megascopic fossils. The common species are *Helopora fragilis, Phaenopora ensiformis* and *P. explanata.* Brachiopods are also plentiful with *Coelospira hemispherica* outnumbering all others. *Stropheodonta corrugata* is more restricted but in a few localities this form is the dominant fossil.

The Furnaceville is the lowest of the Clinton formations in which there is a good microfauna. All of the more common ostracods of the *Zygobolba excavata* zone have been identified from this formation. They are particularly abundant and well preserved in the ore pits at Fruitland (section 8, p. 134). For a complete list of the fossils occurring in this and other formations, the reader is referred to table 3, p. 18–21).

Origin. The origin of the Furnaceville is closely associated with that of all Clinton iron ores. This subject has been the source of much scientific discussion in the literature. It does not lie within the scope of this report to go into a detailed discussion of that topic. Those who are interested, will find excellent discussions by Newland

and Hartnagel ('08, p. 45–53), Smyth ('92, p. 487–96) and Singewald ('11, p. 301–8).

In recent years the sedimentary origin of the Clinton iron ores has been in favor with most geologists. The results of the present study seem to confirm the sedimentary hypothesis. The fossils which make up the typical fossiliferous iron ores probably were replaced before they were covered by the overlying strata. This is shown not only by the intimate association of these replaced fossils with the oolites of hematite, but also by the fact that some of the fossils themselves appear to have acted as the nucleus for concentric bands of hematite similar to the concentric banding of the oolites. It is presumed that since oolites of hematite are known to be forming at the present time in a lake in Switzerland they are probably of primary origin. The relatively common interbedding of unreplaced fossiliferous limestone and typical iron ores is certainly another strong argument in favor of a primary sedimentary origin. In a few places some secondary replacement was observed. On Densmore creek ,near the middle of the formation is a highly fossiliferous layer which shows some secondary hematite. The concentration of iron decreases toward the center. Joint planes show a high concentration of iron immediately surrounding them. Such occurrences are rare and appear to be very recent in origin.

As a formation the Furnaceville was deposited in a narrow area extending from Monroe county on the west to Madison county on the east. The original north and south extent is not known. To the north erosion has probably removed considerable. To the south gas wells encounter a hematitic iron ore at the Furnaceville horizon more than forty miles from the line of outcrop. While the Furnaceville was forming in this narrow area, the clastic Oneida was being laid down to the east, and the lowest portions of the more normal marine Reynales was being deposited to the west.

The broken, worn and rubblelike condition of the fossils of the Furnaceville shows that the sea was probably very shallow and that waves and currents were active. The variable character of the formation may indicate that the currents and other forces acting in the shallow water tended to divide the sea into local areas or small basins which were more or less connected but which possessed a certain definite set of individual characteristics. In some local areas one class of organisms flourished and in others a wholly different class dominated. In some conditions were such that very few oolites of hematite formed; in others these were in abundance. In some basins very little argillaceous, calcareous and other foreign matter collected; in others the foreign matter greatly exceeded the hematitic material.

However vague and uncertain the actual conditions which led to the formation of this hematitic limestone may be, one fact stands out clear and undeniable. The Furnaceville was connected, as all other Clinton iron ores were, with the movement of the strand line. In Furnaceville time the sea was advancing and spreading eastward.

Reynales Limestone

Definition. The lowest Clinton limestone was called by Hall ('43, p. 62–64) the "Pentamerus Limestone of the Clinton Group." Hartnagel ('07, p. 14–15) named the formation the Wolcott limestone. When he introduced this designation, he was not aware of the fact that there were two *Pentamerus* limestones in Wayne county. Newland and Hartnagel ('08, p. 21–23) discovered the existence of two such limestones but did not assign geographic names to them. Chadwick ('18, p. 344–45) restricted the use of Wolcott to the upper *Pentamerus* limestone of Wayne county and introduced the name, Reynales, for the lower. Although the designation was taken from Reynales Basin, he clearly stated that one must visit the outcrops at Lockport and the Genesee gorge to see the entire section exposed. From this statement it is clear that Chadwick intended the Reynales to apply to the Lower Clinton limestone of the Lockport area. In the Rochester area he restricted the Reynales to apply only to the limestone which lay above the Furnaceville iron ore.

Chadwick also ('18, p. 342–43) introduced the term, Bear Creek shale. This was to apply to a shale underlying the Furnaceville on Bear creek, which he stated was Black creek of the topographic map. This locality about five miles northeast of Wolcott had been mentioned previously by Newland and Hartnagel ('08, p. 68). Hall ('43, p. 76–77 and '52, p. 83) apparently had this same outcrop in mind when he described the pelecypod fauna "in the shales beneath the ore bed at Wolcott." Chadwick carried the name, Bear Creek, west and applied it to the three feet of a somewhat argillaceous limestone underlying the Furnaceville at Rochester.

Under the main ore horizon at the old Devoe ore pit (section 21, p. 154) located on a tributary of Black creek which is still known locally as Bear creek, there are just eight inches of shale and thin sandy limestone on top of the Thorold sandstone. These layers are only slightly fossiliferous and contain no pelecypods. The argillaceous limestones and particularly the shales lying above the ore, which was once mined, abound in pelecypods. A very good collection of all the species listed by Hall can be made in a short time. About 13 feet above the main ore bed is another thin hematitic limestone. Although

pelecypods are found above this latter, they are much more numerous below. From these observations it seems quite probable that Hall's pelecypod fauna came from the shale above the main ore bed and below the thin hematitic layer. These same relationships can be seen at Sterling Station (section 23, p. 157).

Ulrich and Bassler ('23, p. 331–34) suggested that the Bear Creek might be used as a designation for the shale carrying many of the same pelecypods but lying entirely above the Reynales of Monroe and Wayne counties. Only a small part of this shale is exposed on Bear creek.

Sanford ('35, p. 177–78) objected to the Bear Creek as it was applied to the three feet of limestone under the Furnaceville at Rochester. He proposed using the Reynales as a formational name and making members of both the Furnaceville iron ore and the Brewer Dock, a name which he suggested for the limestone beneath the Furnaceville.

The Reynales in this report will be used to designate the lowest Clinton limestone formation of western New York. A typical exposure on Johnson creek at Middleport a few miles east of Reynales Basin is used as the type locality. It is suggested that the Brewer Dock, as defined by Sanford, be retained for use in discussing the local geology of Rochester and vicinity. In that area the Brewer Dock is separated from the rest of the Reynales by the Furnaceville. In other parts of western New York where such a condition does not exist, the use of Brewer Dock is not justified and would be confusing. The much misused Bear Creek (see p. 46) is redefined to apply to the argillaceous facies of the Reynales as exposed on the creek which is still locally known as Bear creek. It should be pointed out that Bear creek is not Black creek of the topographic map as stated by Chadwick ('18, p. 342–43) and Sanford ('35, p. 177–78) but a tributary of Black creek (section 21, p. 154).

Extent and lithologic characteristics. In the Niagara gorge the Reynales is about 12 feet thick and is dominantly a dark gray, dolomitic limestone. The basal three feet is pyritic, phosphatic and finely crystalline. It is sparingly fossiliferous but contains a larger number of species than all the rest of the formation. The next five feet is massive-bedded, fine to coarse-grained dolomitic limestone. Overlying this part is three feet of fine-grained, thin-bedded limestone. Many of the individual layers in this portion contain a large amount of argillaceous and silty material. The upper 12 inches is composed of crystalline limestones.

At Lockport the Reynales possesses much the same lithology. The lower two and one-half feet contains pyritic and phosphatic material

with few fossils. Immediately above are a few thin fossiliferous beds, some of which abound in *Hyattidina.* The upper part of the formation remains unchanged.

A short distance east of Lockport the first great change is noted in the Reynales. On Johnson creek at Middleport the formation is still about 12 feet thick. The lower eight feet consists of interstratified, medium gray, silty, dolomitic limestone with thin shale layers separating them. Some of the limestones are composed almost entirely of fossils. *Hyattidina*-bearing layers are very common. Residues of this part of the formation show a great range in the composition of the rocks. Most of the very fossiliferous beds are over 90 per cent soluble in hydrochloric acid. The residue consists dominantly of argillaceous material with minor amounts of silt, sand and chert. The dark gray, dolomitic, nonfossiliferous strata contains much more insoluble material, and some had as much as 60 per cent noncalcareous material. Residues of these also have a considerable amount of argillaceous material, but fine silt is of almost equal abundance. Pyrite and phosphatic nodules are present in minor amounts. The upper four feet of the formation is much less fossiliferous and dense dolomitic limestones are the dominant rock type.

The Reynales passes through another change in lithology between Middleport and Rochester. In the Genesee gorge the three feet of the formation underlying the Furnaceville ore, the Brewer Dock member, has much of the lithologic characteristics of the lower eight feet at Middleport. Dark, argillaceous layers are interbedded with crystalline, medium gray limestone. Some of the layers bear *Hyattidina,* but this fossil is not found so abundantly as in the section at Middleport. Above the Furnaceville are over 13 feet containing the *Pentamerus* layers interbedded with crystalline dolomitic limestones. Some of the crystalline limestones are fossiliferous, but most of them are barren. A few argillaceous unfossiliferous limestone layers are present. Thin shale partings are found throughout the entire thickness.

At the Fruitland ore pits the lower four feet of the formation is thin-bedded. Shale partings or breaks are abundant. Some of the limestone layers are sandy. Fossils are common and most of them are silicified. Overlying this portion are two feet of *Pentamerus*-bearing limestone.

Between Fruitland and Salmon creek there are numerous partial exposures of the formation. The silicified character of the fossils including *Pentamerus* is especially noticeable. The complete section exposed on Salmon creek shows the upper six feet of the formation to be a dark gray, dense, dolomitic, siliceous limestone with an abundance of chert. It is almost barren of fossils. Below this, the formation is more variable in composition. Calcareous shales, thin-crystal-

line, fossiliferous limestones and gray siliceous limestones are interbedded. There are two *Pentamerus*-bearing layers, the fossils of which are only slightly silicified. In the lower three feet of the formation thin stringers of hematitic material are abundant. At the very top of the formation is a thin, lean hematitic layer.

Dark gray shales appear as definite layers rather than as thin shale partings in the Wolcott core. They constitute two feet of the total eleven (section B, p. 159). Since they have the typical lithology of the shale that dominates the rocks equivalent to the Reynales on Bear creek and farther to the east they are significant. The lower two feet of limestone is impregnated with hematitic stringers and closely resembles the Reynales of Salmon creek. Immediately above this is one and one-half feet of limestone which contains the only *Pentamerus* in the Wolcott section. At the very top of the formation is a nine-inch layer of limestone with a thin hematitic layer overlying it.

The amount of shale increases rapidly eastward. On Bear creek, a tributary of Black creek, only five miles northeast of Wolcott the formation is too argillaceous to be designated as the Reynales limestone. Since lithology is the basis for defining formations, the rocks equivalent to the Reynales limestone on Bear creek and eastward are discussed under the heading of Bear Creek shale.

The hematitic limestone occurring at the top of the Reynales on Salmon creek and in the Wolcott core and, as will be discussed later, in the upper part of the Bear Creek shale, is worthy of note because of its remarkable persistence. Chadwick ('18, p. 345) named this hematitic horizon the Sterling Station iron ore. The only objection to considering it as a formation is its thinness, and the fact that it often occurs as stringers imbedded in the uppermost portion of the underlying formation and not as a distinct unit in itself.

In the Niagara gorge the Reynales is underlain by the Neahga. The break between the two formations is sharp, but the relationship is one of apparent conformability. At Lockport the Reynales rests on a thin, green, sandy shale which grades downward into the Thorold. The actual contact of the Reynales and this green, sandy shale is not well exposed. On Johnson creek, near Middleport, the Reynales again overlies a green, sandy shale. Although the lithologies of the shale and the limestone are distinct, and there is little or no question as to the exact contact, the two formations are perfectly conformable. Near the western limit of Monroe county the Maplewood enters the section and separates the Reynales from the underlying Thorold. Throughout the lateral extent of the Maplewood the contact with the Reynales is sharp, but the two formations are also apparently conformable. From the Wayne county line eastward the Reynales is underlain by

the Furnaceville. The Furnaceville is closely related to the Reynales and in some localities the two seem to grade vertically into each other.

In Orleans and Niagara counties the Reynales is overlain unconformably by the Irondequoit limestone. The contact is marked by a wavy surface and the evident truncation of the upper layers of the Reynales. Sanford ('39, p. 77–85) has reported the presence of pebbles of the Reynales in the overlying Irondequoit. Near the western boundary of Monroe county the Lower Sodus enters the section and from that point eastward overlies the Reynales. The contact between the Lower Sodus and the Reynales is always sharp, but there is no evidence of any erosional unconformity. Where the highest layers of the Reynales are marked by a concentration of hematite as on Salmon creek (see p. 49) and in the Wolcott core (section B, p. 159) the hematite is associated with the underlying Reynales and not with the Lower Sodus. No stringers of hematite are found above the contact.

Fauna. The fauna of the Reynales is as variable as its lithology. In the Niagara gorge it is practically barren of fossils. *Coelospira hemispherica* and *Stropheodonta corrugata* are sparingly present. Other forms have been described from these rocks, and a few other species were identified by the writer (section 1, p. 120). No ostracods were found.

At Lockport fossils are much more in evidence, particularly in the thin fossiliferous layers above the basal three feet of the formation. In addition to the species enumerated in the foregoing paragraph *Hyattidina congesta* is very common. Ostracods are rare (section 2, p. 123).

Hyattidina congesta reaches its most abundant development in the vicinity of Reynales Basin. The section exposed at Middleport (section 3, p. 126) contains layers abounding in this species. Crinoid stems are also very numerous, and rival the foregoing brachiopods as rock-forming constituents. Ostracods are rare.

At Rochester *Pentamerus oblongus* is the characteristic fossil of the formation. *Hyattidina congesta* has been found in the Brewer Dock member but in greatly reduced numbers. *Coelospira hemispherica* and *Stropheodonta corrugata* representing the most persistent forms of the Reynales are recognized in both the Brewer Dock member and the higher portions of the formation. *Rhynchotreta robusta* is another common form. Ostracods are much more abundant than in the outcrops to the west, and all four species, characteristic of the *Zygobolba excavata* zone, *Z. excavata, Z. curta, Z. inflata* and *Z. prolixa,* were found (section 5, 6 and 7, p. 127, 131, 133).

Eastward the fauna of the Reynales becomes more diversified. At Fruitland (section 8, p. 134) bryozoans are extremely abundant in the thin strata beneath the *Pentamerus*-bearing rock. *Fenestella tenuis* and *Semicoscinium tenuiceps* are two of the most important. Aside from *Pentamerus oblongus* the four brachiopods, *Stropheodonta corrugata, S. profunda, Coelospira hemispherica* and *Rhynchotreta robusta* are characteristic. The same ostracods are present and are even better preserved than in the sections in the vicinity of Rochester. This is probably explained by the fact that the ostracods at Fruitland are preserved in limestone whereas shale is the containing rock in the Rochester area.

On Salmon creek (section 13, p. 140) bryozoans are rare. The same four brachiopods still form an important part of the total assemblage. *Pentamerus oblongus* abounds in only two layers. The three corals, *Cannopora junciformis, Favosites favosideus* and *Zaphrentis bilateralis* are important. Perhaps the most significant addition is the appearance of pelecypods in considerable numbers in the dark gray shale partings between some of the limestone layers. *Pterinea emacerata, Ctenodonta lata* and *C. mactraeformis* are present. The same ostracods were also collected, but they are neither so common nor so well preserved as at Fruitland.

Origin. The Reynales was laid down in the Lower Clinton sea as that body reached its maximum expanse in New York and Ontario. Limestone and dolomite deposition extended from west of Kelso, Ontario (M. Y. Williams, '19, p. 48–49) to Wolcott in Wayne county. To the east argillaceous material was more plentiful and the Bear Creek shale was forming contemporaneously. Still farther to the east the very clastic Oneida was being laid down along the shore of an ancient land mass.

The close of the Reynales was marked by a partial elevation of the geosyncline and the consequent shrinking of the Lower Clinton sea. In Madison, Onondaga, Cayuga and eastern Wayne counties this shrinking of the sea brought the conditions suitable to the formation of sedimentary hematite which is found at many localities impregnating the uppermost layers of the Reynales and its eastern equivalent the Bear Creek. In some places these conditions persisted long enough to form thin relatively rich hematitic limestone layers which are found capping the Reynales and Bear Creek. The absence of the higher lithologic units of the Lower Clinton suggests that marine conditions may have been forced completely from Ontario and the westernmost counties of New York.

The upper surface of the Reynales in western New York unquestionably shows the effect of erosion. It is undulating and wavy.

Pebbles of the Reynales are found in the overlying Irondequoit. A careful study of this contact has never furnished evidence of any of the overlying Lower Clinton formations. Had these formations been deposited it would seem that there should be some indication of their past existence. Such has never been reported nor found.

Within the sea of Reynales deposition there must have existed a great variety of conditions. This is shown not only by the many types of limestones and dolomites represented, but also by the radical change in fossil content from place to place and layer to layer. It seems reasonable that the crystalline *Pentamerus* layers would require an entirely different set of conditions than that which would produce the dense, unfossiliferous, dolomitic layers.

Certain fossils such as *Coelospira hemispherica* and *Stropheodonta corrugata* were not so exacting in their requirements, and because of this these forms are found in a greater variety of sediments. In fact they are present in all but the most unfossiliferous layers in the Reynales. They are much more abundant, however, in some layers than in others, which would indicate that they also preferred certain living conditions.

Many of the other organisms living at the time were much more exacting in their requirements. *Hyattidina congesta* and *Pentamerus oblongus* serve as examples. Even in areas where these fossils are found, they are confined to very definite layers which tends to show that only at certain intervals were conditions exactly suited to their special needs. The whole class of bryozoans were equally selective of their environment as were also the pelecypods.

This variation in faunal content has been noted by others. Sanford ('35, p. 177–84) would explain these changes by the age of the inclosing strata. The Reynales may be older to the west and younger to the east, as he contends, but there is apparently no way of proving this. All of the fossils common to the Reynales, including the ostracods, are found in the overlying formations with one possible exception, *Hyattidina congesta.* Sanford's views are more fully discussed in an earlier publication (Gillette, '40, p. 52–53).

Ulrich and Bassler ('23, p. 333–34) have explained the presence of *Pentamerus* and bryozoans in the Reynales as a result of a southern connection for the sea. The overlying Lower Sodus with its *Coelospira* and various ostracods, they claim, is indicative of an Atlantic source. Both *Coelospira* and ostracods are found throughout the Reynales and Bear Creek. The *Pentamerus* have a limited lateral extent in New York and in Ontario (M. Y. Williams, '19, p. 48–49). The two areas where the Reynales yields *Pentamerus,* are separated by an area of considerable greater lateral extent which yields no trace of these

fossils. The distribution of these fossils plus the intimate mingling of faunas which they supposed had either definite Altantic or southern origin, can certainly be more easily explained on the basis of ecology.

Bear Creek Shale

Definition. The Bear Creek was originally named by Chadwick ('18, p. 342–43). He used it as a designation for the dark pelecypod-bearing shales which were supposed to underlie the Furnaceville in the town of Wolcott. As pointed out (p. 46) no such shale exists beneath the Furnaceville, but there is a shale formation above the ore which contains the fauna. The Bear Creek is redefined to apply to the pelecypod-bearing shales and argillaceous limestones on Bear creek, a tributary of Black creek in the eastern part of the town of Wolcott in Wayne county.

Extent and lithologic characteristics. The Bear Creek (section 21, p. 154) at its type locality is a dark gray, thin-bedded, silty, slightly calcareous shale with argillaceous limestone layers. Both the shales and limestones are pyritic. The shales are very fossiliferous and the limestones are sparingly so. The lower seven feet are about half shale and half argillaceous limestone. The next six feet are mostly shale. The top of the formation is marked by an eight-inch limestone layer which in turn is overlain by three inches of hematitic limestone.

The Bear Creek is also well exposed except for the basal two or three feet in the ore pits at Sterling Station (section 23, p. 157). Limestones form even a smaller percentage of the total rock. The shales are very fossiliferous. At the top of the formation is a seven-inch limestone layer overlain by approximately three inches of hematitic material. The upper limestone layer is argillaceous and slightly sandy. It weathers brown. It is noteworthy because it has produced a few *Pentamerus*.

Near Martville (section 25, p. 160) the formation possesses the same lithologic characteristics and fossils. To the east it is possible to trace the Bear Creek as far as Lakeport (figure 7, p. 43). The formation pinches out entirely before reaching the outcrops at Verona Station. In correlating the Bear Creek in the diamond drill cores extensive use was made of the hematitic concentration at the top and at the bottom of the formation.

The lower limit of the Bear Creek is easily established. Everywhere it rests conformably upon the Furnaceville iron ore, and thin stringers and layers of sedimentary hematite are found reaching upward into the shale. The upper contact is also marked by a hematitic horizon. At many places this upper concentration occurs as a zone consisting

of shales and interbedded thin layers and stringers of hematitic material in the upper part of the Bear Creek.

Fauna. The Bear Creek is a shale characterized by its pelecypod fauna. Among the most abundant pelecypods are *Ctenodonta lata, C. mactraeformis, Pyrenomoeus cuneatus, Pterinea emacerata, Modiolopsis subalatus* and *Orthodesma curtum.* Lingulas are also important fossils and the species, *Lingula oblata* and *L. perovata,* are found in considerable numbers in some layers. *Coelospira hemispherica* and *Stropheodonta corrugata* range throughout the formation. *Phaenopora ensiformis* and *Tentaculites minutus* are two other common fossils. The ostracod fauna is rich and includes all the species common to the *Zygobolba excavata* zone. *Z. excavata, Z. curta, Z. prolixa, Z. inflata* and others are represented.

Origin. The origin of the Bear Creek is closely associated with that of the Reynales. It evidently formed in the same Lower Clinton sea nearer to the shore and to a source of argillaceous material. The turbulent conditions which resulted, were not suitable to many of the organisms which lived in the comparatively clear seas of the contemporaneous limestone. On the other hand, it did produce an environment much to the liking of the mud-loving pelecypods.

Lower Sodus Shale

Definition. The Sodus shale was named by Hartnagel ('07, p. 13). He intended the term to apply to the lower green shale of Hall ('43, p. 59–60). Both Hall and Hartnagel thought that the Maplewood of the Genesee gorge was the western equivalent of the *Coelospira*-bearing shales of Wayne county. Chadwick ('18, p. 345–46) recognized the fallacy of this contention and restricted the Sodus to the *Coelospira*-bearing shales of Wayne county.

Ulrich and Bassler ('23, p. 369–72) discovered that Chadwick's Sodus shale of the Genesee gorge contained quite a different assemblage of ostracods from that of the Sodus on Second creek in Wayne county. At Rochester the Sodus contained ostracods belonging to their *Zygobolba anticostiensis* zone, the *Z. excavata* zone of this report (see page 24). The Sodus shale which they collected in central Wayne county was found to have those fossils characteristic of their *Z. decora* zone. Because of these microfossils and "in the absence of an unquestionable geographic name" they designated the Sodus of the Genesee gorge as the *Z. anticostiensis* zone. It was suggested that Chadwick's Bear Creek might be the correct name for the *Z. anticostiensis* zone. This suggestion was based upon a comparison of the fauna which they collected from the *Z. anticostiensis* zone with the faunal list of Bear

Creek species given by Chadwick. The term, Sodus shale, was restricted to apply only to those shales containing fossils of the *Z. decora* zone.

The writer ('40, p. 54–68) agreed with Ulrich and Bassler that the lower part of the Sodus contained a microfauna related to their *Z. anticostiensis* assemblage and that the upper part of the Sodus possessed only species common to their *Z. decora* zone. Furthermore, it was pointed out that the two shales were separated by a slight unconformity. The two shales were designated as the Lower and Upper Sodus shales. The type locality of the Lower Sodus was established on Salmon creek (section 13, p. 140).

Since the formations are based upon lithology the separation of the Lower and Upper Sodus shales is subject to some question. Careful studies reveal that there are some minor lithologic differences as will be shown later, but taken as a whole they are dominantly green shales with comparatively thin fossiliferous limestone layers. Even the slight unconformity which separates them on Salmon creek may be of local significance. To the east the section thickens and possibly sedimentation continued throughout the time represented by the unconformity. In the thicker sections the break in microfauna may not be so marked. In fact there may even be an overlapping of ranges and an intermingling of forms. Unfortunately there are no outcrops of the Lower and Upper Sodus contact to the east of Salmon creek and the data derived from well cuttings and cores are inconclusive. In the absence of more definite information to disregard the unconformity on Salmon creek and to give one name to the shales separated by it would be misleading. In using the designations, Lower and Upper Sodus, similarities are implied.

Extent and lithologic characteristics. The Lower Sodus shale is not present a short distance west of the Monroe county line. It appears in western Monroe county and attains a thickness of approximately 18 feet in the Genesee gorge (section 5, p. 127). In that outcrop it is principally a green to greenish gray calcareous, slightly silty, fossiliferous shale with thin limestone layers. The green shales often contain as much as 25 per cent calcareous material and a few residues have shown as much as 40 per cent. Dark gray so-called purple shale layers are interbedded with the green. These dark layers increase downward and the basal four to five feet is dominated by that color. In composition these so-called purple layers are less calcareous. Residues never show as much as 20 per cent calcium carbonate and average less than 10 per cent. They carry more slit-size particles and are slightly more siliceous. The limestone layers vary from a fraction

of an inch to three inches in thickness. In the upper three feet of the formation there are three prominent layers which contain over 95 per cent calcareous material. These three layers are composed almost entirely of *Coelospira* and represent what have been commonly called "pearly layers." There are other thin limestones which contain no *Coelospira*. These are not so pure in composition. In the lower 10 feet the limestones are very scarce and do not exceed one-half inch in thickness. In this portion they are very argillaceous and some even take on the color of the shale.

Between the Genesee gorge and Salmon creek (section 13, p. 140) there is little change in the Lower Sodus. At Salmon creek it is approximately 20 feet thick. The lower six feet consists of dark gray shale. Throughout the rest of the formation dark gray and green shales are interstratified with the green dominating toward the top of the section. The pearly layers are confined to the upper part of the formation. They appear thicker than in the Genesee gorge and one which forms the very top of the formation, is seven inches thick.

In Oswego county the Lower Sodus is over 25 feet thick. Here also the lower part is dominantly a dark gray shale with the upper part containing the same green to greenish gray layers. The *Coelospira*-bearing limestones are confined as in other areas to the upper part. In the lower 10 feet at Lunn's quarry (section 25, p. 160) thin very fine-grained sandstones or silt stones are present. These partings which are usually less than a quarter inch thick, are limonitic in the weathered outcrop. The fossils which cover the surfaces of the silt stones, are preserved as limonitic casts and molds. The shale layers themselves contain many fossils which are similarly preserved. In the less weathered exposures pyrite is very common. It is likely that the limonitic casts and molds were originally pyritized fossils.

By means of the diamond drill cores the Lower Sodus can be traced as a formation as far east as Lakeport in Madison county. At that place the ostracods show that there is at least 11 feet and not more than 15 feet of Lower Sodus. Between Lakeport and Verona Station, Oneida county, the formation pinches out. In general the cores show that the typical greenish gray shales gradually disappear eastward. The dark gray shale layers dominate the whole section between Brewerton (section F, p. 182) and Lakeport (section G, p. 183). The limestones even in the uppermost part of the formation lose their clear, crystalline, pearly character and become brown to brownish gray in color and much more sandy.

As already pointed out in detail, the contact of the Reynales and the Lower Sodus is sharp but conformable in Monroe and western Wayne counties. In central Wayne county the contact of the Rey-

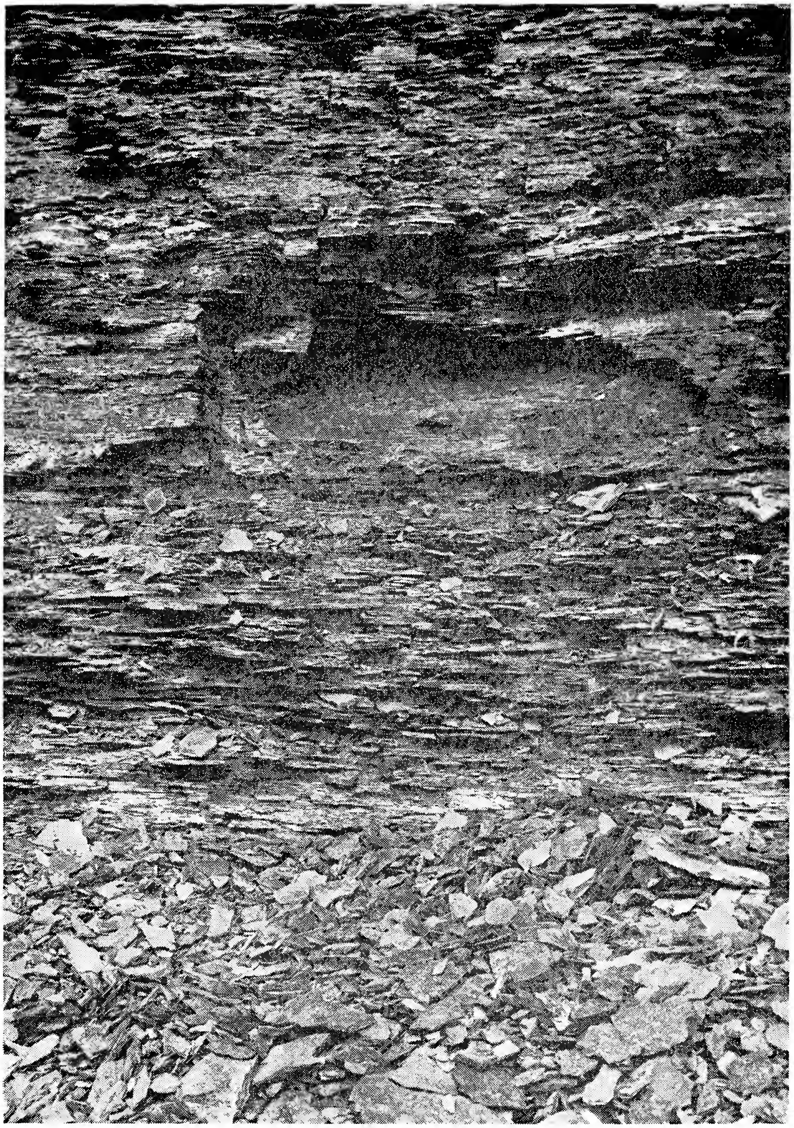

Figure 8 Genesee Gorge. Williamson-Lower Sodus contact. Note three inch shell rubble separating formations

nales and the Lower Sodus is marked by a thin hematitic limestone. In eastern Wayne county the Reynales becomes a shale, the Bear Creek. This latter formation underlies the Lower Sodus eastward beyond Lakeport, where both appear to wedge out against the Oneida. In most cores the boundary between the two formations is marked by a concentration of hematite in the upper part of the Bear Creek.

In the Genesee gorge the Lower Sodus is immediately overlain by the Williamson shale of the Upper Clinton. The boundary is marked in some places by a shell rubble which attains a maximum thickness of three inches (see figure 8, p. 57). At other places small pebbles up to a centimeter in diameter are found lying on the upper surface of the Lower Sodus. In still other places a more or less sharp break in the stratigraphic sequence is the only evidence of the erosion to which the strata must have been subjected prior to the deposition of the Williamson. In Wayne county the Lower Sodus is separated from the Upper Sodus by an erosional unconformity, as shown by the wavy surface of the underlying shale. To the east of Wayne county there are no exposures of the contact and its character is unknown.

Fauna. The Lower Sodus is a highly fossiliferous formation. The actual number of individual species collected, however, is not so great as in some of the less fossiliferous formations of the Clinton. Furthermore, not a single species collected from the Lower Sodus is confined to that formation.

The brachiopods are the most abundant of all classes of organisms represented. The common Lower and Middle Clinton *Coelospira hemispherica* and *Stropheodonta corrugata* are present in great numbers throughout the section. The bryozoans are equally well represented by the cylindrical *Phaenopora ensiformis* and others. *Tentaculites minutus* of the conularia is another species which abounds in all types of rock. At Lunn's quarry it is so plentiful that thin layers are found made up almost entirely of this poorly understood fossil. The pelecypod fauna is rich and varied but unlike the others these are restricted and occur only in the dark gray shale layers. They reach their maximum development in the basal part of the Sodus in Wayne and Monroe counties. The species are identical with those which were found in the Bear Creek shale. The most common forms are *Ctenodonta machaeriformis, Pyrenomoeus cuneatus, Cyrtodonta alata* and *Pterinea emacerata.*

The microfauna is also plentiful. The ostracods abound in both the green and dark gray shales and also in the limestone layers. In the shales they are usually represented by natural casts. In the pearly layers their actual shells are often obtainable. The most common

species are *Zygobolba excavata, Z. curta, Z. inflata, Z. rectangularis* and *Z. prolixa.*

Origin. Ulrich and Bassler ('23, p. 269) believed that the Sodus formed as a result of an Atlantic invasion. They based their arguments on the differences in the fauna of the Sodus shales and the Reynales limestone. This latter formation, they considered, had a southern origin. As already shown the Reynales bears ostracods which were supposed to be of Atlantic origin. The *Coelospira* and *Stropheodonta* are both found in abundance in the underlying Reynales. The pelecypods are the same. *Tentaculites minutus* and *Phaenopora ensiformis* are also common to both. In fact if there are any forms confined to the Lower Sodus, they are very rare. Certainly sedimentary environment could easily explain any differences which exist.

The writer believes that following the general shrinking of the Lower Sodus sea at the close of Reynales-Bear Creek deposition, a gradual depression of a small part of the geosyncline permitted the formation of the Lower Sodus. It is possible that the sea was forced completely from New York at the close of the Reynales, but if this occurred it soon returned. The thin upper portion of the Bear Creek and the Reynales which contains the stringers of hematite, can be traced uninterruptedly for long distances. Even the thin hematitic limestone, found capping the Reynales and Bear Creek, shows no evidence of erosion.

Since both the Bear Creek and the Lower Sodus wedge out against the Oneida between Lakeport and Verona Station, it seems safe to say that the eastern shoreline was somewhere in the vicinity of Verona Station. Although the upper few feet of the Oneida contain ostracods of the *Zygobolba decora* zone, probably a large part of the conglomerate outcropping at Verona Station actually formed contemporaneously with the Bear Creek and the Lower Sodus. The western limit of the area receiving sediments must remain a matter of pure speculation. The Lower Sodus pinches out rapidly west of the Genesee gorge. In Orleans and Niagara counties the Reynales is directly overlain by the Irondequoit of Upper Clinton age. Without a doubt erosion has modified the original distribution of the formation (see p. 50).

Iron was not so plentiful in the restricted Lower Sodus seas as in the Reynales, but in eastern Wayne and Oswego counties the finely disseminated pyrite in the unweathered rocks indicates that the metal was present in considerable quantities. Its presence as pyrite rather than hematite indicates that most of the rocks were deposited under reducing conditions.

The occurrence of identical dark gray shales with the same pelecypod fauna in both the Lower Sodus and Bear Creek suggests that conditions which brought about their formation were similar. These shales with their linguloid brachiopods and many pelecypods which probably represented a slimy environment, formed throughout the early part of the Lower Sodus in western Wayne and Monroe counties, and reoccurred at intervals to the very close of the sedimentation. At times, as represented in the upper part of the Lower Sodus in Monroe, Wayne and Cayuga counties, the sea became less ladened with mud and silt. This resulted in the deposition of the green calcareous shales. In restricted areas and for short intervals the sea became so free from argillaceous, siliceous or other clastic material that the pearly limestone layers formed. The fossils in these limestones are not broken or worn and for this reason they apparently lived where they are found, and were not swept into certain sheltered areas by current action. The fact that these layers can not be traced for any distance tends to point to the conclusion that the environment under which they formed, was local.

Upper Sodus Shale

Definition. The Upper Sodus shale was named by the writer ('40, p. 58–63) from the typical exposures on Salmon and Second creeks in the town of Sodus, Wayne county. The term was applied to the upper part of the Sodus shale of Hartnagel ('07, p. 13) and Chadwick ('18, p. 345–46) and corresponds to the restricted Sodus of Ulrich and Bassler ('23, p. 331–33).

Extent and lithologic characteristics. The Upper Sodus is absent in the Genesee gorge, but it enters the section a short distance to the east. At Fruitland in extreme western Wayne county it reaches an estimated thickness of 20 feet. It continues to thicken eastward, and in the vicinity of Salmon (section 13, p. 140) and Second (section 14, p. 142) creeks, the type localities, it is 34 feet thick (figure 9, p. 62).

The lithology of the Upper Sodus at the type locality closely resembles that of the underlying Lower Sodus. The lower part is dominantly a green to greenish gray, calcareous, highly fossiliferous shale with the same pearly layers. In this basal portion there are a few dark gray or purple shale layers, but they are less abundant and always much thinner than in the underlying formation. Upward in the section the dark gray layers disappear entirely. In the upper ten feet bluish gray, highly fossiliferous shales gradually replace in importance the greenish gray shales. This bluish gray shale in the

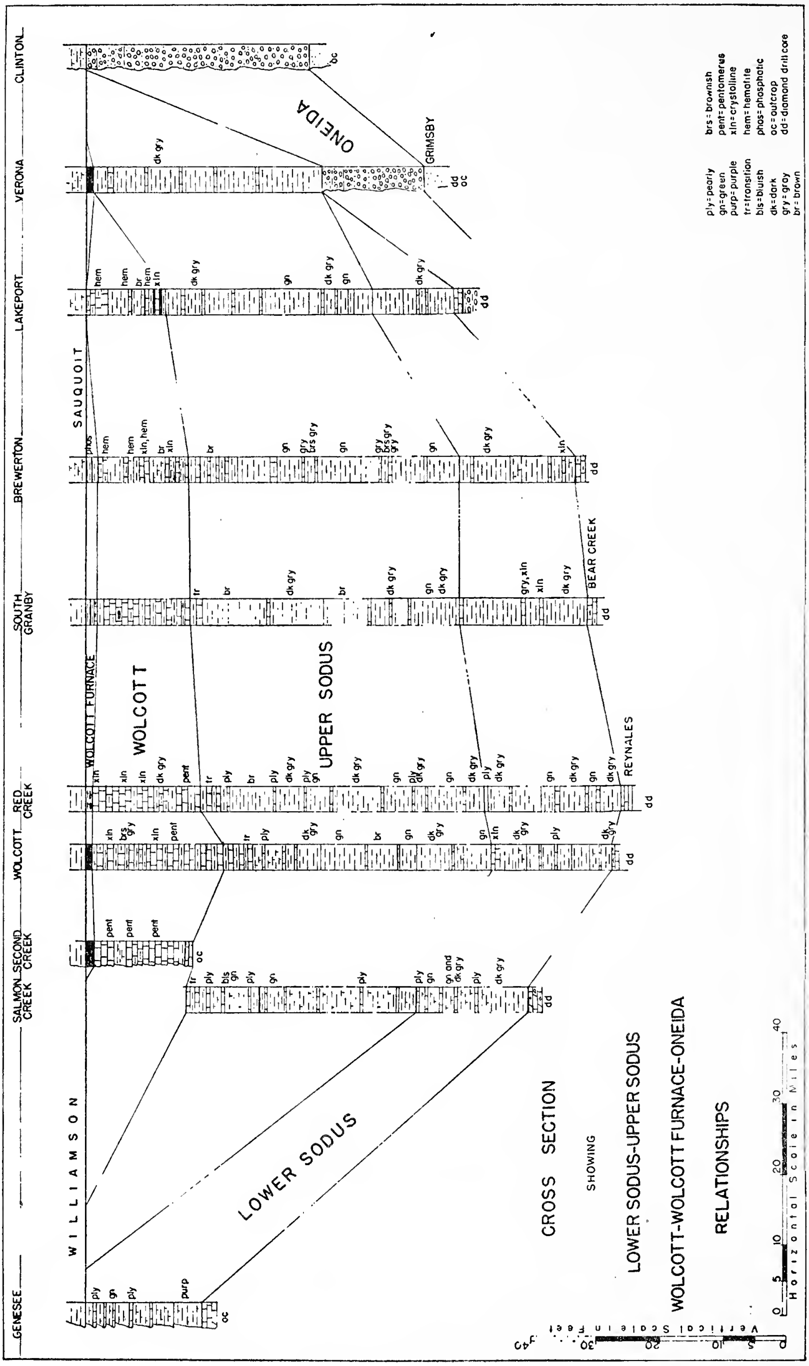

Figure 9 Cross section showing Lower Sodus-Upper Sodus-Wolcott-Wolcott Furnace-Oneida relationships

unweathered section, as in the cores, is a brownish gray. The pearly layers continue throughout the Upper Sodus to within four feet of the top, but become less numerous upward. Other non-*Coelospira*-bearing limestones appear in the section near the middle of the formation. They become more abundant upward. Some are light gray, unfossiliferous, clear, crystalline limestones. Others are fossiliferous with a brown to yellowish brown color. As in the Lower Sodus the pearly layers average 90 per cent calcareous material. Residues of the non-*Coelospira*-bearing limestones show that their carbonate content is considerably less. The crystalline limestones are on the average about 85 per cent soluble in hydrochloric acid. The brown to yellowish brown layers vary from a low of 68 per cent to a high of 83 per cent. The residues of the pearly and clear crystalline limestones consist almost entirely of fine siliceous silt. The impurities of the brown to yellowish brown layers are clay, pyrite, limonite and silt in the order named.

In the Red Creek core (section C, p. 178) the Upper Sodus is between 42 and 44 feet thick. It attains its maximum thickness in eastern Cayuga and western Oswego counties, where it is estimated to be about 50 feet. The whole formation is not exposed anywhere in this area, but fragmentary outcrops show that the lithology is similar to that of the type localities.

At South Granby (section E, p. 180) there are about 42 feet of the Upper Sodus. At Brewerton (section F, p. 182) about 42 feet and at Lakeport (section G, p. 183) about 32 feet can be assigned to the formation. In this area the Upper Sodus undergoes some lithologic changes. The silty, slightly calcareous, dark gray or purple shales which were so rare and confined to the lower part of the formation at the type localities are found in increasing abundance eastward. At Lakeport there is a total of less than six feet of the typical green to greenish gray shale. The pearly layers also decrease, and at Lakeport there is only one true pearly layer near the middle of the formation.

At Verona Station (section H, p. 185; section 31, p. 164) the thickness of the Upper Sodus shale is 36 feet. This includes some shale which is equivalent to the Wolcott limestone (see p. 68). The shale is uniformly dark greenish gray in color with thin limestone layers. None of these can be considered pearly layers. The shale is silty, and the thin limestones are very sandy. In the upper three feet of the formation there are a number of thin, calcareous, ferruginous sandstones interbedded with the shale. The sandstones are very fossiliferous containing an abundance of ostracods.

The Upper Sodus pinches out rapidly against the Oneida conglomerate east of Verona. It is entirely missing at Willowvale.

Where the Lower Sodus lies beneath the Upper Sodus, the basal contact has been discussed in detail (p. 59). To the east of Lakeport the Upper Sodus rests on and interfingers with the Oneida conglomerate. The thin shale layers, bearing the typical microfauna of this formation, are found separating the uppermost layers of the conglomeratic Oneida at Verona Station (section 31, p. 164). The contact of the Wolcott and Upper Sodus is everywhere gradational. The boundary is always arbitrarily placed where the limestone layers predominate over the shale. In the vicinity of Verona Station the formation is overlain by the Wolcott Furnace iron ore or its eastern equivalent, the contact is easily determined, but there are stringers of hematite in the upper few feet of shale.

Fauna. Like the Lower Sodus the Upper Sodus is very fossiliferous, but the number of individual species is not great. Brachiopods are the most abundant of all megascopic fossils. *Coelospira hemispherica* and *Stropheodonta corrugata* again are found to dominate the class. The bryozoans are more plentiful in the Upper Sodus. *Phaenopora ensiformis* and *P. constellata* are found throughout the formation, but the latter is rare except in the upper part. *Fenestella tenuis* and *Semicoscinium tenuiceps* are confined to the bluish green shale layers in the upper ten feet of the formation. *Holopea obsoleta* is the only true gastropod found in any abundance. This form is so common that a few layers in the upper part of the Sodus at Second creek (section 14, p. 142) are composed almost entirely of this fossil. *Tentaculites minutus* is still an important fossil. Pelecypods play a much less important role in the Upper Sodus than in the Lower Sodus.

Ostracods are very plentiful. Most of them are preserved as natural casts, and if they were not present in such great numbers, specific identification would be difficult. *Zygobolba decora, Z. robusta, Z. intermedia* and *Z. inflata* are found ranging from the very base to the top of the formation. *Mastigobolbina incipiens* and *M. retifera* are also present, but these two forms occur only in the upper part. Of all the ostracods occurring in this formation only *Z. inflata* is found in the underlying Lower Sodus.

Origin. The unconformity at the base of the Upper Sodus in Wayne county points to the conclusion that marine conditions temporarily left the area after the deposition of the Lower Sodus. The sharp break in microfauna adds to this conclusion. There is no way of determining even relatively the duration of time represented by this small break. Ulrich and Bassler ('23, p. 369–72) point out that their *Zygobolba anticostiensis* zone corresponding to the *Z. excavata* zone (p. 24) of this report is separated from the *Z. decora* zone by

600 feet of calcareous shale and limestone on the island of Anticosti. Of course this evidence may be misleading, and the absence of ostracods in the rocks intervening between the two zones may be due to any one of many causes. In other words the true range of either or both may not be shown at Anticosti.

There is the possibility that the sea did not withdraw completely from New York State. On Fish creek (section 9, p. 135) near Fruitland the formation is overlain by the Wolcott limestone and is roughly 20 feet thick. At Wallington it is 34 feet and in Cayuga county it is approximately 50 feet. At all of these places the two ostracods, *Mastigobolbina incipiens* and *M. retifera,* which appear to be restricted to the upper portion of the formation are present. This points to the conclusion that the Upper Sodus probably reached its maximum development near its close. It may be that a slight relative elevation of the land may have forced the seas from western New York into deeper parts of the basin to the east or possibly to the south. Another slight shift in the relative position of land and sea would have caused the sea to spread out once more into western New York.

Similarities in megascopic fauna and lithology suggest that throughout most of Wayne, Cayuga and Oswego counties the Upper Sodus probably formed under conditions very like those of the Lower Sodus. The same green shales and pearly layers are dominant. Toward the close of Upper Sodus sedimentation bluish gray shales were being deposited, and these are the first evidence of a change in environment which was to culminate in the formation of the Wolcott limestone. The bluish gray shales while containing *Coelospira* and other forms common to the Lower Sodus are characterized by the presence of lacy bryozoans.

The gradual change in the character of the formation is noted eastward. In Oneida county conditions were vastly different from those of Wayne county. Here in addition to the characteristic fossils, pelecypods and cephalopods are found in abundance. The pearly limestones are entirely absent. The shales are dark greenish gray and contain a greater percentage of silt and fine sand.

Wolcott Limestone

Definition. Hartnagel ('07, p. 14) named the Wolcott limestone. He intended the designation to supplant Hall's ('43, p. 62–64) descriptive title "Pentamerus Limestone of the Clinton Group." Both Hall and Hartnagel failed to recognize that there were two *Pentamerus* limestones in the Clinton. Newland and Hartnagel ('08, p. 21–23) discovered this fact but did not give geographic names to the formations. Chadwick ('18, p. 347–48) restricted the Wolcott and applied

it to the upper *Pentamerus* limestone occurring in Wayne county and incidently to the only limestone bearing these fossils outcropping within the town of Wolcott.

Extent and lithologic characteristics. Nowhere in the vicinity of Wolcott are the entire 22 feet of the formation exposed. By studying the outcrops on Mudge (section 17, p. 149), Wolcott and Little Wolcott (section 19, p. 151) creeks, a good idea of the lithology can be obtained. The diamond drill core which was recovered near Wolcott (section B, p. 159) adds greatly to the understanding of the lithologic characteristics of the formation.

The Wolcott at its type locality is a limestone with an abundance of shale layers. The lower three and one-half feet consists of brownish or bluish gray, very argillaceous, fossiliferous limestone with thin crystalline limestones and brownish or bluish gray (see p. 63), slightly silty, calcareous to very calcareous shale. The shale accounts for nearly 50 per cent of the total thickness. In the next ten feet coarse, crystalline, fossiliferous limestones dominate the section accompanied by the same brownish gray, calcareous shales. In this portion slightly over seven feet are limestone and the remainder shale. The upper nine feet of the formation are thin-bedded. Crystalline limestones, brown argillaceous limestones and brownish gray shales occur in equal amounts. The two types of limestones account for nearly six feet of the total.

To the west of the type locality the thickness of the Wolcott decreases. On Second creek (section 14, p. 142) it is approximately 15 feet. With the thinning the formation appears to have become less shaly. Above the basal three feet, which are half shale, are seven feet of massive-bedded limestone with only a few shale partings separating the layers. In the upper five feet limestone accounts for slightly more than three feet of the total. On Salmon creek (section 10, p. 135) in the town of Williamson the Wolcott is only seven feet thick, and the shale is found only as partings between the massive limestone layers. At Fruitland on Fish creek (section 9, p. 135) it measures only six feet, the upper 18 inches of which are limestone and the remainder about half limestone and half shale. The Wolcott pinches out between Fruitland and Rochester and is entirely missing in the Genesee gorge (figure 9, p. 62).

East of the type locality the Wolcott can be recognized in the Red Creek (section C, p. 178) and South Granby (section E, p. 180) diamond drill cores. The limestone layers become more argillaceous and the crystalline layers less common. The relative proportion of the brown shale increases east of Red Creek. In both of these cores the Wolcott is roughly 16 feet thick. Between South Granby and

Brewerton as revealed by the Brewerton core, the Wolcott becomes a brown, very calcareous shale with a few limestone layers. The formation is capped by an iron ore as in the Wolcott area but throughout the upper half of the formation are thin stringers of hematite. Fourteen feet are assigned to the Wolcott at Brewerton.

In the Lakeport core (section G, p. 183) the Wolcott is 10 feet thick. Here the limestones are even less prominent and those which do occur are all brown to yellowish brown in color. All the limestones carry some trace of hematite and at the base of this section a lean iron ore is developed. Two very thin, calcareous sandstones are present, one at the base and the other about five feet higher in the section. The basal sand is hematitic and roughly two inches thick. The other measures approximately an inch. Between Lakeport and Verona Station the Wolcott either pinches out completely or becomes so shaly that it can not be distinguished from the Upper Sodus.

Except at Lakeport the lower limit of the Wolcott is everywhere indefinite and passes gradationally downward into the underlying Upper Sodus. At Lakeport the break between the two formations is sharp. A thin hematitic sandstone separates them.

Where the Wolcott is overlain by the Wolcott Furnace iron ore its upper contact is also gradational. In a few places where the ore is entirely missing, the contact with the overlying formations is sharp and unconformable, and is marked by an abrupt change in lithology.

Fauna. Since the only outcrops of the Wolcott limestone are in Wayne county, the discussion of the fauna must be largely confined to that area. In reality the formation possesses two assemblages of fossils, one more or less confined to the limestone layers, the other to the shales. *Pentamerus oblongus* is by far the most abundant of all the fossils. There are many limestone layers composed almost entirely of this fossil. Besides their typical occurrence in the crystalline limestone layers, they are sparingly found in the brown argillaceous limestones. At only one place were they found in the shales. The shale layer containing them, outcrops on Mudge creek (section 17, p. 149) and although having a definite shaly structure it is 46 per cent soluble in acid. Brachiopods most commonly associated with *Pentamerus* in the limestone layers include *Rhynchotreta robusta, Atrypa reticularis* and *Rhipidomella circulus.*

In the shale layers bryozoans are the most important fossil. Some layers on Second and Mudge creeks are found to be literally packed with lacy bryozoans, *Fenestella tenuis, Semicoscinium tenuiceps* and *Rhinopora verrucosa. Coelospira hemispherica* and *Stropheodonta corrugata* rank first in abundance among the brachiopods. *Leptaena rhomboidalis* and *Platystrophia biforatus* are also common.

Ostracods are not so abundant in the Wolcott as in the underlying formations. Only at Fish creek (section 9, p. 135) near Fruitland was the writer able to find these fossils in the limestone, and even there they were rare. In the shales, however, they occur at every outcrop. In these layers they are always natural casts or impressions and are poorly preserved. The species in order of their abundance are: *Zygobolba decora, Mastigobolbina incipiens, M. retifera* and *Z. robusta.*

Origin. The Wolcott type of sedimentation began evolving before the Upper Sodus came to a close. First the brownish or bluish gray shales (see p. 63) with their bryozoan fauna commenced forming at intervals and alternating with the greenish gray sedimentation of the typical Upper Sodus. The conditions conducive to the deposition of the brownish gray shale were dominant late in the Upper Sodus. Intervals of relatively clear water favorable to the formation of fossil limestones occurred throughout the Upper Sodus. The frequency of these intervals increased and lengthened. *Coelospira* were no longer wholly responsible for their formation, and other fossils played an increasing role even before the beginning of the Wolcott. When the limestone deposition was of such duration, that it resulted in the formation of more of this type of rock than shale, the Wolcott is considered to have arrived.

The exact extent of the Wolcott sea in western New York is problematical. It was most certainly subject to erosion before the deposition of the overlying formations. Some calcareous pebbles with a lithology of the Wolcott limestone were found in the Genesee gorge between the Lower Sodus and the Williamson. The pebbles suggest that the Wolcott sea extended at least as far west as the Genesee valley.

In central New York a different problem is involved in determining the extent of the Wolcott sea. The Wolcott as a formation can be traced as far east as Lakeport without difficulty. Some of the limestones remain characteristic of that place. Between Lakeport and Verona Station these limestones disappear. As previously pointed out, the shales of the Wolcott are very like those occurring in the highest portion of the Upper Sodus of Wayne county. The shale of the Wolcott passes through lithologic changes eastward, but so do the shales of the Upper Sodus. The result is that the two shales are indistinguishable at Verona Station. The microfauna of both the Wolcott and the Upper Sodus is the same. The megafauna is of no assistance. The long range and persistent forms of both formations are the only ones found common to Verona Station and in Wayne county outcrops. For these reasons it is impossible to

say how much of the rock found at Verona Station formed contemporaneously with the Wolcott limestone of Wayne county. Since there are no rocks at Willowvale containing fossils characteristic of the Wolcott or the Upper Sodus, the shore line must have been somewhere between that point and Lakeport.

Within the Wolcott seas of western New York conditions were radically different from those existing during the deposition of the underlying formation. In some restricted areas and for varying intervals of time *Pentamerus* thrived to the exclusion of most other forms. A short distance away the ecology was different and other organisms lived contemporaneously. This is illustrated strikingly on Mudge (section 17, p. 149) and Second (section 14, p. 142) creeks. On Second creek there is a rather spectacular three and one-half foot section composed of massive limestone layers bearing a profusion of *Pentamerus*. This section is located about five feet above the base. On Mudge creek there is no such mass of *Pentamerus*-bearing rock exposed anywhere. The corresponding three and one-half feet contain *Pentamerus* layers, but they are separated by shales and other limestones. On Mudge creek the lowest *Pentamerus* layer is 14 inches thick, and this is followed by 18 inches of shale. The shale is literally packed with bryozoans. On Little Wolcott creek the lowest *Pentamerus* is only eight inches thick, and it is followed by 12 inches of thin-bedded limestones and shales. The shales contain *Coelospira, Stropheodonta* and an occasional *Platystrophia*. Many attempts have been made to trace layers and successions of layers in outcrops and diamond drill cores. All were unsuccessful. These facts seem to suggest that the Wolcott was a sea which possessed many types of environmental conditions contemporaneously.

In the vicinity of Brewerton and to the east as shown in the Brewerton (section F, p. 182), Lakeport (section C, p. 178) and Verona Station (section H, p. 185) cores and outcrops at Verona Station, the limestones and shales abound in thin stringers of hematite. In the Brewerton core the stringers are confined to the upper five feet. At Lakeport they occur throughout the whole thickness with a lean ore about one-foot thick occupying a position immediately above the basal sand. At Verona Station there is no rock which can be definitely assigned to the Wolcott (see p. 68), but oolites are found in the shale underlying the main ore body for a distance of 14 inches. The presence of these hematitic layers would tend to show that conditions favorable to the formation of ores started occurring during Wolcott time in central New York. These are probably the first evidences of the retreat of the Lower Clinton

seas. Their geographic distribution suggests that they formed only a short distance from the actual shore line.

Wolcott Furnace Iron Ore

Definition. The Wolcott Furnace iron ore was named by Chadwick ('18, p. 347–49) from an exposure at Wolcott Furnace, where it was worked commercially for a short time. It had previously been recognized by Newland and Hartnagel ('08, p. 23), who had designated it as the upper hematitic seam.

At the same time Chadwick ('18, p. 346) named the Wolcott Furnace iron ore, he proposed the term Verona iron ore. This latter name was to apply to the ore mined at Verona Station. Chadwick considered this formation to underlie the Wolcott limestone which in turn was overlain by the Wolcott Furnace iron ore. As previously stated (p. 69) there is a concentration of hematite at the base of the Wolcott in the Lakeport section (section G, p. 183). At Verona Station (section H, p. 185) the iron ore is immediately overlain by the Sauquoit shale with its characteristic Middle Clinton fauna, and underlain by rocks which resemble the Upper Sodus. Whether the Verona is to be correlated with either the lean ore of the basal Wolcott in the Lakeport core, or directly with the Wolcott Furnace iron ore is a matter of conjecture. The writer prefers to hold as closely as possible to lithology in defining formations. On this basis it seems justifiable to designate all formations dominantly hematitic at the top of the Lower Clinton as the Wolcott Furnace iron ore. As with the Furnaceville iron ore if every lentil of hematitic-bearing rock were to be given a name, the literature would be burdened with many confusing terms whose significance would be highly questionable.

Extent and lithologic characteristics. The Wolcott Furnace iron ore outcrops at its type locality in the bed of Wolcott creek. It is only about a foot thick and is dominantly of the fossiliferous type. The calcareous content is always high but varies noticeably from layer to layer. At the very top of the formation is a two inch, dark gray, sandy layer with abundant phosphatic nodules.

To the west the Wolcott Furnace iron ore can be traced as far as Second creek (section 14, p. 142). Here it is 18 inches thick and consists of hematitic limestone and shale. At the center of the formation is a highly calcareous layer which shows a relatively high concentration of iron. The thin limestones and shales comprising the remainder of the rocks assigned to the formation possesses only scattered oolites of hematite. The formation has no positive representatives west of Second creek. In the Wallington core (section A,

p. 175) a few scattered oolites in the upper two feet of thin bedded Wolcott may possibly indicate the Wolcott Furnace horizon. East of Wolcott the formation also pinches out. In the Red Creek core (section C, p. 178) a thin seam about an inch in thickness overlain by a thin shaly layer containing phosphatic nodules is its only indication. To the south of the type locality this formation apparently extends about ten miles to where it disappears. The extent and distribution of this formation in the Clyde and Sodus Bay quadrangles is discussed in some detail in an earlier publication (Gillette, '40, p. 68–71).

At South Granby (section E, p. 180) the Wolcott Furnace horizon is marked by a hematitic layer about three inches thick. Here thin hematitic bands begin appearing in the upper layers of the underlying Wolcott. At Brewerton (section F, p. 182) the ore is again only three inches thick and the upper part of the underlying Wolcott is again impregnated with thin seams of hematitic material. In the Lakeport well (section G, p. 183) the horizon is represented by a layer of shale containing phosphatic nodules and a few oolites of hematite. In this well almost every limestone layer shows a hematitic content.

At Verona Station (section H, p. 185) the Wolcott Furnace was worked commercially for a number of years. It averages about 15 inches thick and is again dominated by the fossiliferous type. As in other areas the Wolcott Furnace is highly variable. Analyses and other data given by Newland and Hartnagel ('08, p. 67) show a rapid change in thickness and iron content within a radius of one-half mile. The Wolcott Furnace is not known east of Verona Station (figure 9, p. 62).

The contact of the Wolcott and the Wolcott Furnace is everywhere gradational. On the other hand the upper limit of the formation is always sharp and well-defined. In Wayne county a thin conglomeratic sandstone separates the Wolcott Furnace from the Williamson. In Oneida county the actual contact is now covered by water. The variation in thickness may indicate the effect of erosion. Certainly the change in lithology is abrupt.

Fauna. The fauna of the Wolcott Furnace iron ore closely resembles that of the underlying Wolcott. In Wayne county the hematitic limestone contains in order of abundance: the bryozoans, *Helopora fragilis* and *Phaenopora ensiformis;* the coral, *Chaetetes lycoperdon;* the brachiopod, *Coelospira hemispherica.* In the calcareous, hematitic shales on Second creek *Fenestella tenuis* and *Semicoscinium tenuiceps* are very common. These shales also yield

Coelospira hemispherica and other brachiopods. Ostracods are not found in this formation in Wayne county.

At Verona Station the assemblage is quite similar. The notable exceptions are the relative unimportance of the lacy bryozoans and the abundance of ostracods. *Zygobolba decora, Z. robusta* and *Mastigobolbina incipiens* are the most common forms and are diagnostic of the *Z. decora* zone.

Origin. The absence of any sharp break between the Wolcott and the Wolcott Furnace iron ore and the close similarity of their respective faunas suggest that they were deposited in the same sea. The hematitic phase appears to have been connected with the shrinking or withdrawal of the sea, which is interpreted as having brought about the formation of small, more or less isolated pools, in which hematite was deposited. As the recession began the first areas to feel the effect would be those shallowest and nearest the shore. This would account for the appearance of hematitic-bearing strata low in the Wolcott of the Oneida Lake area. The recession seems to have been accompanied by numerous readvances which temporarily restored normal marine environments. This would explain the presence of hematitic stringers in the shales and limestones in the eastern or near shore areas throughout the Wolcott. Considerably later elevation caused the sea to migrate westward and brought the hematitic-forming conditions to Wayne county. Finally this elevation forced the sea completely from New York.

MIDDLE CLINTON

Sauquoit Shale

Definition. Chadwick ('18, p. 341) proposed the name Sauquoit to apply to "all the sandstone and shale beds between the Oneida conglomerate and the oolitic ore bed in the Oriskany and Sauquoit valleys." The type locality was established on Swift creek north of Sauquoit village. Chadwick considered the formation as thus defined to embrace the eastern equivalents of the Sodus, Martville and perhaps Maplewood and other horizons. Ulrich and Bassler ('23, p. 337–39) through a study of the fauna came to the conclusion that these beds were Middle Clinton in age. They retained the term Sauquoit.

Since the Sauquoit is dominantly a shale, it is considered best to designate it as such. The formation does contain a few sandstone layers, and at Willowvale a number of conglomerates are present in the formation. Even so the sandstone and conglomerates form a small percentage of the total thickness (see figure 10, p. 73).

Figure 10 Willowvale. Sauquoit shale. Hammers mark upper surface of conglomeratic layer

Extent and lithologic characteristics. The Sauquoit, as exposed on a small tributary flowing into Sauquoit creek at Willowvale (section 34, p. 171), is truly a heterogeneous mixture of rock strata. It is dominantly a shale, but it contains sandy shales, calcareous shales, conglomerates, sandstones and even a few limestones. The formation can be divided into two parts, each possessing a certain dominant type of lithology and possessing certain faunal characteristics. It is quite possible that these two parts are distinct enough to justify formational names. Since Willowvale, however, marks the easternmost of the outcrops included in this report, and the exposures of rocks of Middle Clinton age are so few and fragmentary to the west, no subdivision is attempted.

At the base of the exposed section at Willowvale is a massive conglomeratic layer 18 inches thick. This may possibly represent the top of the Oneida, but from other outcrops in the vicinity it seems more likely that the true Oneida lies roughly ten feet below the lowest exposure. Overlying the conglomerate is 12 feet of highly fossiliferous, dark bluish gray shale. The shale is highly siliceous with the quartz present as very fine sand and silt. These shales are in turn overlain by 30 feet of dark bluish to greenish gray, silty and sandy shale. Conglomeratic layers are common and many of them occur as boulderlike masses completely surrounded by shale. The surfaces of the conglomeratic layers are always found to be very irregular. Wave and ripple marks together with mud cracks are much in evidence in this portion of the formation. Near the center of the interval is a number of sandy limestones and calcareous sandstones. The top of this lower part of the Sauquoit is poorly exposed (figure 11, p. 76), but its location is marked by the highest conglomeratic mass observed at Willowvale.

The upper part of the formation is a bluish green, fissile, slightly sandy, silty shale about 40 feet thick. Present are many thin sandstones, which never exceed two inches in thickness and average less than one-half inch.

At Verona Station (section 31, p. 164) the approximate thickness of the Sauquoit is 90 feet. Two divisions are noticeable but because of the fragmentary nature of the outcrops, the thickness of each could not be determined. The lower part is a bluish gray shale similar in many respects to the lower portion of the formation at Willowvale. There are no conglomerates, and there is a decided increase in the number of sandy limestone layers. The upper part is the same dark green, fissile shale found at Willowvale.

In the Lakeport core (section G, p. 183) the Sauquoit is 75 feet thick. The lower 50 feet are a bluish gray shale with thin limestones.

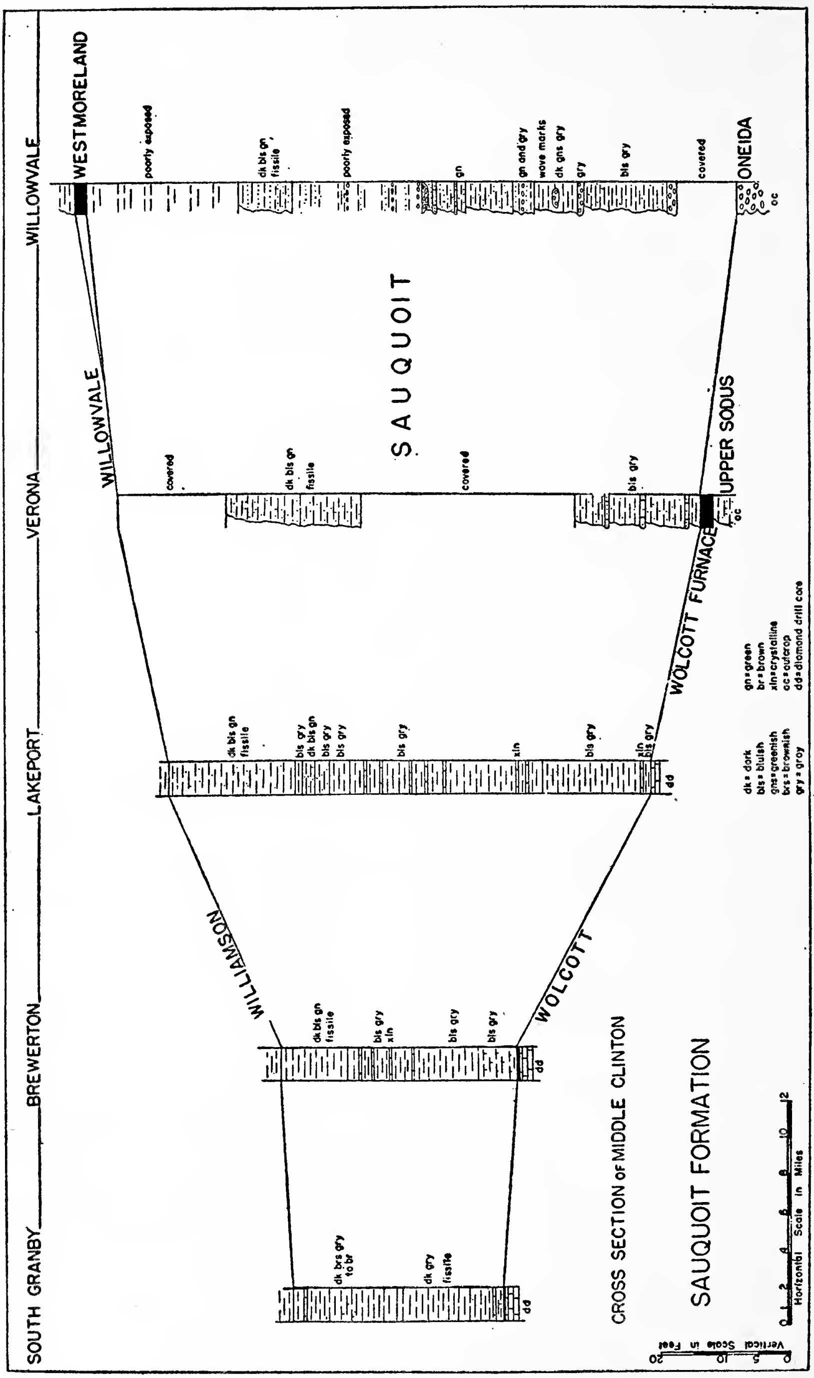

Figure 11 Cross section of Middle Clinton Sauquoit formation

This shale appears to grade into the dark bluish green, fissile portion, which accounts for the upper 20 feet (figure 11, p. 76).

At Brewerton (section F, p. 182) the Sauquoit is only about 36 feet thick. Even with this reduction in thickness the same two divisions are discernible. The upper fissile portion is represented by 10 feet (figure 11, p. 76). Between Brewerton and South Granby (section E, p. 180) the Sauquoit loses only four feet of thickness. The two divisions are not so easily recognized. The upper part is slightly more fissile than the underlying strata. The rock as a whole is more calcareous and less sandy. Between South Granby and Red Creek the formation pinches out completely.

In the vicinity of Willowvale the Sauquoit appears to grade downward into the Oneida conglomerate. At Verona Station and to the west the formation is separated from the underlying Wolcott and Wolcott Furnace by a sharp break which apparently represents an erosional unconformity. The upper contact is sharp and well-defined, wherever it can be seen. At Willowvale and Clinton the overlying formation is the Westmoreland iron ore. At Lakeport and Brewerton the Williamson is found in contact with the Sauquoit (section F, p. 182, section G, p. 183).

Fauna. Collectively the megafauna of the Sauquoit forms a distinct and recognizable unit, but when viewed as individual species few are found to be actually confined to the Sauquoit. Some range downward into the Lower Clinton and others upward into the Upper Clinton formations.

Pelecypods are more numerous than any other class of organisms. The long range *Ctenodonta machaeriformis* and *Pterinea emacerata* are very common. *Cyrtodonta alata* not identified from the Upper but well represented in the Lower Clinton is another very abundant fossil. Less in number but well represented are the Upper Clinton *Amphicoelia orbculoides* and *Leptodesma rhomboidea.* Brachiopods rank second. *Coelospira hemispherica* is particularly abundant in the lower part of the Sauquoit. This fossil is identical with the *Coelospira* found throughout the Lower Clinton. *Leptaena rhomboidalis, Rhipidomella circulus, Atrypa reticularis, Chonetes cornutus* and *Rhychonella bidens* are also common. The first three are long range species but the last two are confined to the Middle and Upper Clinton formations.

Two gastropods, *Bucanella trilobata* and *Cyclonema varicosum,* are well represented. These fossils appear in the overlying Upper Clinton but not in so great abundance.

Trilobites are comparatively rare. *Liocalymene clintoni* and a

species of *Dalmanites* which is closely related to *limulurus,* possibly *lunatus,* are the most common forms. Both have a decided Upper Clinton affinity.

Ostracods are found in great numbers throughout the entire thickness of the formation. Furthermore the forms present are confined to the Sauquoit and are so different from those found in either the overlying Upper Clinton or the underlying Lower Clinton that they can not possibly be confused. *Mastigobolbina lata* var. *nana, M. vanuxemi, M. clarkei, Zygobolbina conradi* are the important fossils of this class.

Origin. The sharp break at the base of the Sauquoit indicates that marine waters were forced from New York state by a relative elevation of the basin after the deposition of the Wolcott Furnace iron ore. In Pennsylvania, Maryland and other Appalachian regions Ulrich and Bassler ('23, p. 372–74) and F. M. Swartz ('34, p. 112–17) report the presence of rocks with *Zygobolba emacerata* assemblage (see p. 22) between those containing the *Z. decora* and the *Mastigobolbina lata* forms. From these observations it is possible that the Clinton sea did not completely withdraw from the Appalachian region but was forced into the deeper portion of the geosyncline which at that particular time lay south of New York.

Sometime during the Middle Clinton a renewed down warping of the geosyncline brought a return of marine waters to central New York. Since the deposits of the Middle Clinton are confined to a relatively narrow area, the sea probably flooded only a small part of the state. If the present distribution of the rocks is any guide, this invasion extended on the east into Herkimer county and on the west into Cayuga. That eastern Oneida county was relatively near to a land mass of considerable relief during the deposition of the lower part of the Sauquoit is shown by the abundance of conglomeratic layers. Furthermore, the presence of mud cracks, wave marks and ripple marks appear to indicate that eastern Oneida county was actually under shore conditions at times during the deposition of the lower part of the Sauquoit. Later the seas appear to have spread eastward. This would account for the covering of the conglomeratic mud cracked portion of the Sauquoit by the fissile-bedded strata which probably formed in an area at some distance from any beach or shore line.

The clastics in the lower part of the Sauquoit become less important westward from Willowvale. A few thin sandstones are found at Verona Station. Neither in the outcrop at Verona Station nor in the cores at Lakeport and Brewerton are there any conglomerates.

From these observations it seems safe to conclude that actual beach conditions never extended west of eastern Oneida county during the Sauquoit. Furthermore the reduction in the amount of coarse clastics westward tends to indicate the source of these lay to the east as in the Lower Clinton.

UPPER CLINTON

Williamson Shale

Definition. The name, Williamson shale, was proposed by Hartnagel ('07, p. 15) for the lithologic designation "Second Clinton Shale", of Hall ('43, p. 64–65). As Hartnagel then used the term in the Rochester area, it combined in a single unit the Williamson and the Lower Sodus shale. Chadwick ('18, p. 348–49) limited the Williamson to the graptolite-bearing shale lying above the Wolcott limestone in Wayne county.

Extent and lithologic characteristics. The Williamson shale enters the Clinton section between Oak Orchard creek in Orleans county and the Genesee gorge. In the gorge this formation is about six feet thick and is a dark green to black, calcareous to slightly calcareous, fissile, graptolite-bearing shale. The upper part, which is predominantly dark green, contains a few thin limestones. The limestones are particularly evident near the contact of the Irondequoit and the Williamson. Most of the truly black graptolite-bearing layers are in the basal portion. Some, but not all, of these graptolite shales have a central waferlike layer which is highly calcareous. The black argillaceous material which gives its color to the whole thin layer, appears to be firmly pressed into and frozen to both the upper and lower surfaces of the central calcareous matrix. On Salmon creek (section 10, p. 135) in the town of Williamson, the type locality, the formation is about seven feet thick and exhibits the same lithologic characteristics. The first change, worthy of note, appears in the outcrops on Second creek (section 14, p. 142). Here the Williamson is over 17 feet thick. The black, fissile graptolite-bearing rock is confined to a few feet in the lower part. The rest of the formation is dark green in color and is also very thin-bedded. Thin limestones some of which are composed almost entirely of *Plectambonites* range throughout the entire thickness. Whereas pyrite is sparingly present in the outcrops to the west, it is very abundant in this locality. Pyritized fossils are common in the shales. In addition several distinct layers of pyrite are present. Most of these are less than a quarter of an inch in thickness, but at least two are over a half inch thick. These layers which are composed of small almost perfect cubes of

pyrite, are conformable with the over and underlying strata and appear to be definitely sedimentary in origin.

The Williamson of Little Wolcott creek (section 19, p. 151) is roughly 25 feet thick. The most striking change is the disappearance of the black, fissile, graptolite-bearing layers. At this outcrop the bedding planes of the dark green shale layers are often found covered with graptolites. So plentiful are the graptolites that their black color tends to accentuate and emphasize the bedding planes of the dark green shale layers. Much of the shale is fissile, but some of it becomes thicker bedded and may be more correctly described as platy.

To the east, as shown in the Red Creek diamond drill core (section C, p. 178) the Williamson is about 32 feet thick, and possesses the same characteristics as those observed in the outcrops of Little Wolcott creek. Farther east, as seen in the South Granby (section E. p. 180) and Lakeport (section G, p. 183) cores, a separation of the shaly phase at the base of the Irondequoit and the true Williamson becomes increasingly difficult. It is evident, however, (figure 12, p. 81) that the thickness of the Williamson increases toward the east.

Between South Granby and Lakeport are two small but highly significant outcrops. One is located at Phoenix (section 28, p. 162) where the Barge canal was dredged out of the uppermost Williamson and the other is an outcrop of the lowermost Williamson at Brewerton (section 29, p. 163). At Phoenix the formation is a dark green, calcareous to slightly calcareous, platy, graptolite-bearing shale. It closely resembles the platy Williamson of Little Wolcott creek. It has the same thin limestones many of which are composed of *Sowerbyella*. At Brewerton it is likewise a dark green shale, but is inclined to be fissile with the graptolites confined to the bedding planes. Thin fossiliferous limestones are present. Both of these outcrops are of small vertical extent but they do serve to show that the sediments which are assigned to the Williamson and the Irondequoit in the cores, are approximately correct.

The Irondequoit and the Williamson as lithologic units lose their identity east of Lakeport. The eastern equivalent of these two formations is discussed under a separate title, the Willowvale shale.

The unconformity at the base of the Williamson is of considerable magnitude and clearly defines the lower limit of the formation. At Lakeport the Williamson rests on the Sauquoit. It overlaps westward the progressively older formations, the Wolcott Furnace iron ore, the Wolcott limestone and finally the Lower Sodus shale. The upper limit of the formation is not so easily and readily determined. At all outcrops and also in the cores it appears to grade upward into the

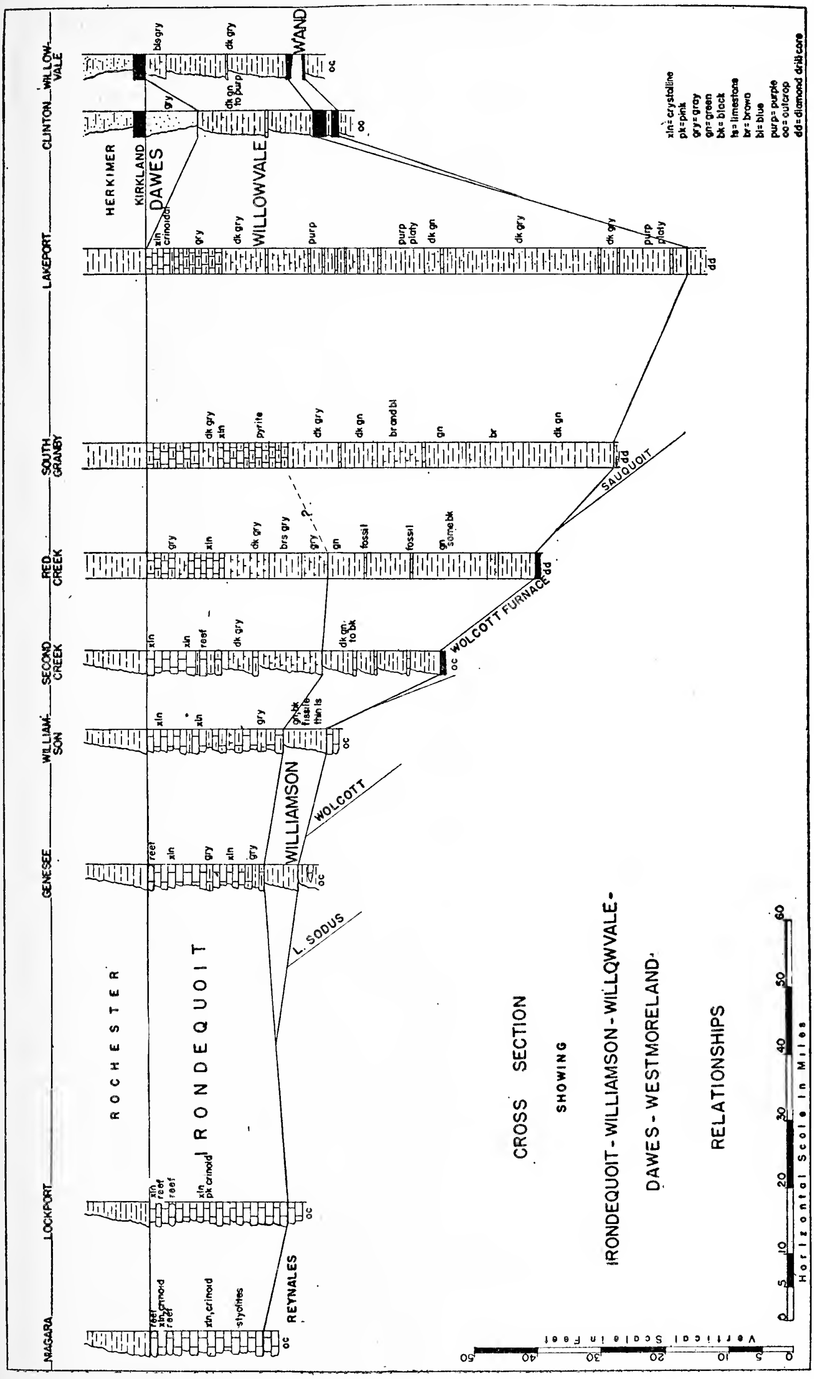

Figure 12 Cross section showing Irondequoit-Williamson-Willowvale-Dawes-Westmoreland relationships

overlying Irondequoit. This is particularly true from central Wayne county eastward.

Fauna. Graptolites are the most characteristic fossil of the Williamson. *Monograptus clintonensis* is by far the dominant species, but *Retiolites venosus* is also present. Graptolites occur more or less abundantly throughout the whole formation. In Monroe and western Wayne counties they are found in greatest number in the fissile black shales. In other places and particularly in eastern Wayne county great tangled masses are often seen covering the bedding planes of the dark green shale layers. The fossils imbedded in the green shale although fewer in number, are less fragmentary. Most of the fossils are flat, sawlike, carbonaceous markings, but occasionally a graptolite is found that has been preserved through calcification.

Brachiopods are second in importance to graptolites. *Sowerbyella transversalis* is the dominant fossil in this class. The shells are so abundant at some horizons that they form limestone layers. Other brachiopods common throughout the formation are *Atrypa reticularis, Spirifer radiatus, Cyrtia meta, Scenidium pyramidale, Bilobites biloba, Chonetes cornutus* and *Coelospira sulcata.*

The other classes of megafossils are as a whole poorly represented in the Williamson. True corals are rare, but at Brewerton *Palaeocyclus rotuloides* is present in considerable numbers. A few fossils of this species have also been found in the outcrops on Little Wolcott creek. The trilobite, *Liocalymene clintoni,* is particularly abundant at Phoenix. In the other outcrops of the formation this fossil is rare.

Most of the ostracods characteristic of the *Mastigobolbina typus* zone are present in the Williamson. A new species of *Dibolbina* is very abundant and ranges throughout the formation. It appears to be confined to the Williamson. A variety of *Beyrichia lakemontensis* is also plentiful. Unlike the *Dibolbina* n. sp. it occurs sparingly in the overlying Irondequoit. *Mastigobolbina punctata* is rare in the lower part of the formation but is common in the upper. *M. trilobata* has never been identified from the lower portion but is present in the upper. *M. typus* itself is confined to the uppermost layers of the Williamson and is rare even in that portion.

Origin. After the deposition of the Sauquoit central and western New York was subjected to a period of erosion of considerable duration. From the work of Ulrich and Bassler ('23, p. 347–49, 374–75) and F. M. Swartz ('34, p. 112–17) it appears that Maryland, Pennsylvania and other areas in the Appalachian region were receiving sediments throughout the time represented by this break in the stratigraphic sequence of New York. The development of thin

basal sandstones and conglomerates as well as the truncation of older formations is accepted as evidence that this unconformity can not possibly be explained by nondeposition or by marine scouring. A relative downward movement of the geosyncline brought marine waters back into New York in the Upper Clinton time.

Based upon the thickness of sediments the path of the Upper Clinton invasion may have been through Madison county. Thence it spread out westward over a low-lying land surface, and eastward it encroached more slowly upon a higher land mass. It is readily recognized that the thickness of sediments is a poor indication of the time consumed in deposition, and the thick section in Madison county compared with that in the western part of the state, may have resulted from the fact that it was relatively near a source of clastics.

An alternative suggestion might be that the marine waters spread out over the whole of western New York and reached as far east as westernmost Oneida county within a brief period of time. Based strictly upon the character of the sediments, this explanation seems plausible. In Niagara county where the source of clastics was far to the east the Irondequoit is almost free from argillaceous material. In Monroe county shale layers appear in the Irondequoit and the argillaceous Williamson is found at its base. In Madison county the pure, crystalline limestones account for a very small part of the entire section (figure 12, p. 81). This theory, however, is not entirely corroborated by fossil evidence. *Beyrichia* aff. *lakemontensis* and *Dibolbina* n. sp. are the only two ostracods which are abundant throughout the Williamson. The former is sparingly found in the Irondequoit and the latter is confined to the Williamson. *Plethobolbina typicalis* is found in the Irondequoit but never in the Williamson. The fossils then point to the fact that the Williamson is probably older than the Irondequoit.

The lack of any good outcrops in the Oneida Lake region makes it extremely difficult to postulate the eastern shore line during the deposition of the Williamson. There is some basis for believing that the Williamson sea extended beyond Clinton and that the Westmoreland iron ore represents the type of sedimentation which was restricted to that locality during the Williamson. The thin shale layers between the oolitic ores yield the two ostracods, *Dibolbina* n. sp. and *Beyrichia* aff. *lakemontensis,* which, as already shown (p. 82), are rather indicative of the Williamson. The same shale, however, which is particularly rich in the ostracods of the *Mastigobolbina typus* zone, yields *Plethobolbina typicalis* which in western New York is not found below the base of the Irondequoit. Sandstones containing the *Mastigobolbina typus* ostracods are found about 15 miles

east of Willowvale. From the occurrences of ostracods it seems possible that the Westmoreland formed in an area not far from the eastern shore and may be partly contemporaneous with the Williamson of western New York.

Conditions within the area receiving the sediments of the Williamson were certainly not uniform. In Monroe and eastern Wayne counties black shale abounding in graptolites but relatively barren of other evidences of past life, formed during a part of the Williamson. Whatever the environment that was responsible for the black shales, it did not extend over the whole area. Eastward dark green, platy, much more fossiliferous shales with thin highly fossiliferous limestones were deposited contemporaneously.

The abundance of pyrite and particularly the presence of thin layers of this mineral in Wayne county indicate that the marine waters carried even in this western area a high concentration of iron. Its occurrence as pyrite rather than as the oxide leads to the conclusion that it was deposited under reducing conditions in contrast with the oxidizing condition which led to the formation of the Westmoreland ore of Oneida county.

Irondequoit Limestone

Definition. Hartnagel ('07, p. 16) named the Irondequoit limestone after the town of Irondequoit in Monroe county. It replaced Hall's ('43, p. 65–67) lithologic designation, "Upper Limestone of Clinton Group."

Extent and lithologic characteristics. The Irondequoit is exposed in the Niagara gorge and in the "Gulf" at Lockport. In this area it is as a whole remarkably uniform for Clinton formations. It is a light gray, coarsely crystalline, crinoidal, pyritic limestone. When unweathered, many of the large crystals have a pinkish cast. Styolitic structures are very common throughout the formation. In a layer immediately above the sharp break between the Irondequoit and the Reynales, Sanford ('39, p. 77–85) records the presence of large pebbles of Reynales limestone embedded in the typical Irondequoit matrix. The only other lithologic feature interrupting the uniformity of the formation is the lenticular, fossiliferous, bluish gray, argillaceous limestone masses which have been called reefs. These always occur in the upper part of the formation and extend up into the basal Rochester. Some of the so-called reefs extend as much as 30 feet along the face of the outcrop and have a position roughly paralleling the bedding planes. The writer has observed many which exceeded four feet in height and Kindle and Taylor ('13) report some with a maximum height of ten feet.

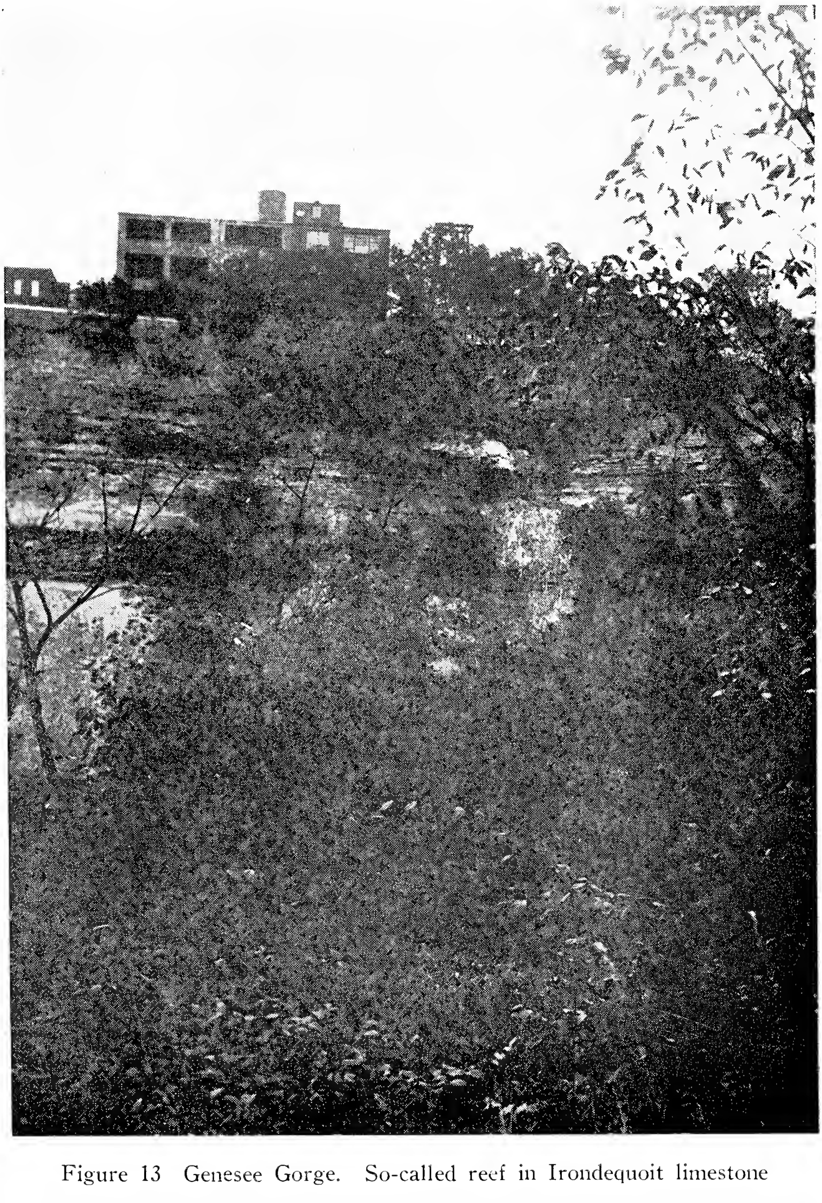

Figure 13 Genesee Gorge. So-called reef in Irondequoit limestone

For all its uniformity in composition the Irondequoit of Niagara county appears to vary considerably in thickness from place to place. Two measured sections at Lockport show a difference of over two feet. It is this irregularity which is probably responsible for the varying thickness reported by geologists: Hall ('43, p. 67) 20 to 25 feet, Grabau ('01, p. 97) 11 feet, Kindle and Taylor ('13) 10 to 15 feet, Alling ('36, p. 189–204) 13.5 feet and Sanford ('39, p. 77–85) 12 feet. The sections measured at Lockport reveal 18 to 20 feet. These two outcrops are about one-eighth of a mile apart. The blue prints of cores put down during the construction of the Barge canal at Lockport and made available to the writer through the courtesy of C. A. Hartnagel show a thickness of 22 feet. It does not seem possible that all these irregularities can be due to errors in measurement. The unconformity at the base of the Irondequoit is very pronounced, and the filling in of the irregularities in the surface upon which the Irondequoit was deposited, is probably responsible for the varying thickness.

In the Genesee gorge (section 5, p. 127) the upper part of the formation has the same coarse crystalline appearance, but lower in the section the limestones become increasingly argillaceous. The argillaceous content reaches a maximum at and immediately above the contact of the Williamson. Thin, dark gray, calcareous shales separate the more massive limestone layers in the lower half of the formation. Pyrite is a prominent mineral occurring throughout the Irondequoit, but is particularly abundant as disseminated cubes in the coarse crystalline layers. The so-called reefs are much in evidence and are restricted to the upper portion (see figure 13, p. 85). The Irondequoit in the Rochester area has a uniform thickness of about 18 feet.

On Second creek (section 14, p. 142) the Irondequoit can be roughly divided into two parts. The lower and thicker part is a crumbly, calcareous, dark gray, fossiliferous shale; the upper contains the crystalline limestone layers with dark gray, calcareous, very fossiliferous shale partings. The two grade into each other through a zone characterized by dark gray argillaceous limestone. The so-called reefs in this area extend from the argillaceous limestone underlying the crystalline limestone into the lowest layers of the Rochester. The total thickness is 27 feet.

In the Red Creek core (section C, p. 178) a further increase in the shale content is noted. In the South Granby (section E, p. 180) and Lakeport (section G, p. 183) cores a line of separation can not be drawn with any degree of accuracy between the Williamson and the Irondequoit, but each of these cores do contain crystalline lime-

stone and dark gray, calcareous shale layers, which possess all the lithologic characteristics of the Irondequoit. The upper crystalline limestone layers in the Lakeport core contain thin stringers or seams of oolitic hematite, and some of the massive crinoid stems so characteristic of the formation are replaced by hematite (see figure 12, p. 81).

To the east of Lakeport it is impossible to assign to the Irondequoit any definite portion of the sections. Rocks occupying the stratigraphic interval are designated as the Willowvale and will be discussed under a separate heading.

The contact of the Irondequoit with the Williamson is everywhere gradational, and it becomes more pronounced eastward, as the lower part of the Irondequoit becomes increasingly argillaceous. To the west of Monroe county the Irondequoit rests unconformably upon the upper eroded surface of the Reynales. In western New York where the outcrops are available the contact of the Irondequoit with the overlying Rochester is marked by a distinct break in lithology. No evidence, however, has ever been found of any unconformity separating the two formations. In Wayne county and to the west the so-called reefs are found in both the Rochester and the Irondequoit. This would seem to point to a close relationship of the two formations. In the area to the east of Wayne county where the contact is not exposed, the cores obtained show a distinct break in lithology. The uppermost Irondequoit is always a crystalline, crinoidal limestone upon which rests the gray shales of the Rochester.

Fauna. The Irondequoit really possesses three distinct faunas, one characteristic of the crystalline limestone layers, another developed in the thin shales separating the crystalline limestone layers and associated with the so-called reefs, and the third found in the lower, shaly portion of the Irondequoit of Wayne and Cayuga counties.

Many of the limestones are made up almost exclusively of crinoid stems. Fossils associated with the crinoid stems are relatively few in number and consist of cup corals and brachiopods. The most common species of brachiopods are *Atrypa reticularis, Leptaena rhomboidalis, Whitfieldella cylindrica, W. intermedia* and *Spirifer radiatus.*

The thin shales between the massive limestones and the so-called reefs of Niagara, Orleans, Monroe and Wayne counties yield a much larger assemblage. Some of the more common are *Schuchertella subplana, Orthis tenuidens, Dalmanella elegantula, Sowerbyella transversalis, Dictyonella coralifera, Spirifer radiatus, S. niagarensis, S. sulcata, Atrypa reticularis, A. rugosa, Atrypina disparilis, Whitfieldella nitida* and *W. intermedia.* Bryozoans are very abundant.

The most characteristic are *Eridotrypa striata, Rhinopora verrucosa, Semicoscinium tenuiceps* and *Phylloporina asperato striata.* The trilobite, *Dalmanites limulurus,* and the cephalopod, *Dawsonoceras annulatum,* are two other important fossils.

The fauna of the lower or shale phase of the Irondequoit in Wayne and Cayuga counties is also dominated by brachiopods but by quite a different assemblage. In these strata *Whitfieldella intermedia, W. cylindrica, Chlorinda fornicata, Orthis tenuidens, Scenidium pyramidale, Spirifer radiatus, Cyrtia meta* and *Sowerbyella transversalis* are the characteristic and most abundant forms. Trilobites are common and include *Liocalymene clintoni, Encrinurus ornatus* and *Phacops trisulcatus.*

From the above list of common species the megafauna of the Irondequoit shows a transition from the typical Williamson to the Rochester. These forms associated with the shaly portion are very similar to those found in the Williamson, whereas the fossils in the thin shale partings in the upper part of the Irondequoit closely resemble the Rochester assemblage.

The microfauna of the Irondequoit includes all the forms diagnostic of the *Mastigobolbina typus* zone with the exception of *Dibolbina* n. sp. A list of the more common species includes *M. typus, M. punctata, M. trilobata, Plethobolbina typicalis* and *Beyrichia* aff. *lakemontensis.* The microfauna then shows the close relationship existing between the Irondequoit and the Williamson.

Origin. As already pointed out (p. 82) the Irondequoit was probably deposited in a continuation of the same sea in which the Williamson formed. In Irondequoit time the sea continued to spread westward, and in so doing it reached into regions where argillaceous material was less accessible. Clear crystalline limestones of Niagara, Orleans and western Monroe counties are the proof for this assumption. Eastward, still considerable argillaceous material was being carried into the waters from the land mass. With the advance of the sea this source of argillaceous material, however, was moved farther and farther to the east. This probably explains the formation of the clear crystalline crinoidal limestones in the uppermost part of the Irondequoit as far east as Lakeport.

There is some evidence which seems to point to a minor recession of the strandline westward into Madison and Oneida counties late in Irondequoit times. The position of the Dawes sandstone at Clinton shows that a portion of Oneida county was under continental or beach influences while the upper Irondequoit was still forming in western New York. The rapid thinning of the rocks (figure 12,

p. 81) carrying the forms typical of the *M. typus* zone may in part be due to erosion during this minor recession. Certainly to the west there is no indication of a removal of the sea at the close of the Irondequoit.

The vast increase in numbers and the greater variety of the megascopic fossils of the Irondequoit indicates that conditions changed considerably during the Irondequoit from those prevailing in Williamson time. Graptolite-bearing shales could no longer form. On the other hand the crumbly, dark gray lower shale facies of the Irondequoit provided an ecology suitable to most of the other megafossils, which had thrived throughout the Williamson. Further changes in the late Irondequoit produced an environment which was apparently conducive to a much greater number of individual species. So alike are the fauna and lithology of the shale breaks representing the deposits of the late Irondequoit and the rocks of the early Rochester that they obviously formed under similar conditions and derived their clastics from the same source. Of course some of the dissimilarity in fossil content may be due to the difference in age of the rock of the Lower and Upper Irondequoit, but certainly not all.

The origin of the so-called reefs in the upper part of the Irondequoit in western New York has not been adequately explained. Sarle ('01, p. 81–82), studying these lenticular masses in the Rochester area, came to the conclusion that they were formed by certain bryozoans. The writer ('40, p. 36) observed these same bryozoans in the reefs on Second creek and accepted Sarle's explanation. Bryozoans may have aided greatly in their formation in many areas, but more extensive observation leads to the conclusion that they could not have been wholly responsible. Some reefs have no bryozoans whatsoever. Many in the Lockport and Niagara sections are composed largely of crinoid stems and brachiopods. A study of the fossils from the reefs in this area shows that they possess the same species common to the thin shales of the upper Irondequoit of Wayne and Cayuga counties. It may be suggested that these lenticular masses were formed by current action that swirled the light argillaceous, organic material into piles and mounds on the ocean floor, and that the fossils found in these mounds originally lived under conditions similar to those which resulted in the deposition of the shale layers to the east.

Westmoreland Iron Ore

Definition. The Westmoreland is introduced as a designation for the oolitic iron ore of Smyth ('95, p. 104) and Newland and Hartnagel ('08 p. 26–27 and p. 61–64). The type locality is on a tribu-

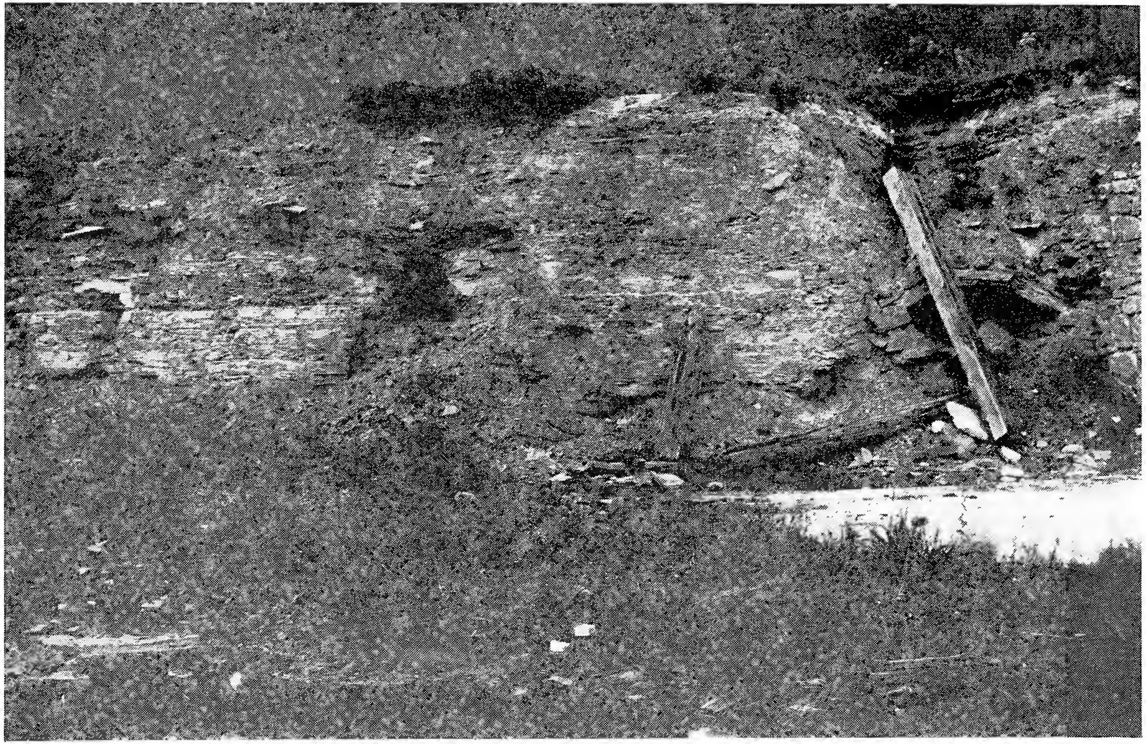

Figure 14 Clinton, New York. Old Borst iron ore mine

tary of Oriskany creek approximately one-half mile east of the hamlet of Lairdsville in the town of Westmoreland, Oneida county. Its best exposure are in the ore mines within the limits of the village of Clinton. The formation is overlain by the Willowvale and underlain by the Sauquoit.

Chadwick ('18, p. 346) incorrectly correlated the Westmoreland with the ore occurring at Verona Station. At Clinton the Westmoreland is underlain by the Sauquoit. At Verona Station the hematite bearing rock is overlain by the Sauquoit. Hence the Verona iron ore of Chadwick which is designated as the Wolcott Furnace iron ore in this report (p. 70) can not be used as a name for the oolitic ore at Clinton and vicinity.

Extent and lithologic characteristics. The Westmoreland has been extensively mined in the vicinity of Clinton in the past (Newland and Hartnagel, '08, p. 58–67) and is still being mined to a certain extent. At first the ore was removed by stripping off the overburden. When the thickness of the overlying shale became too great, underground methods were employed. Many of the old open pits are so badly weathered that it is impossible to obtain rock in place. Some still offer an opportunity to study the Willowvale shale overlying the ore, and at the old Borst mine the upper surface of the Westmoreland remains visible (figure 14, p. 91).

The Westmoreland at its type locality is approximately 18 inches thick. The ore is the oolitic type and appears to have a high iron content. The formation is medium to thin bedded with shale breaks between the layers. There is no evidence of any gradation of the hematite upward into the overlying or downward into the underlying rock. A short distance to the north along the south side of Deans Creek valley the ore becomes argillaceous with a prominent shale parting about seven inches from the base. At this outcrop the ore is only 16 inches thick. The Westmoreland has not been identified any farther to the west.

The Westmoreland reaches its maximum development at Clinton. Here it measures from 30 inches to over three feet. Most of the differences in thickness is due to a prominent shale layer which varies from a thin parting to over a foot in thickness. This shale occupies a position about two feet from the top of the formation. The two hematitic portions of the Westmoreland, separated by the shale, have the same characteristics. Both are oolitic and are high in iron. The shale parting closely resembles the overlying Willowvale. It is dark in color, highly fossiliferous and at some place possesses a thin argillaceous limestone.

Eastward from Clinton the ore outcrops in several places along the road between Clinton and Washington Mills. An accurate estimate of its thickness could not be obtained. Along this same road are various open cuts. Newland and Hartnagel ('08, p. 61) report that the thickness in these cuts ranges from 18 to 24 inches. At Willowvale the ore is poorly exposed but it probably is about two feet in thickness. East of Willowvale the horizon can be traced at least as far as the Herkimer-Oneida county line (Newland and Hartnagel, '08, p. 59–60).

Fauna. The Westmoreland is not a fossiliferous iron ore and if it were not for the shale layers, found within the formation, it would be impossible to tell much concerning its age. Fortunately fossils are found in the shales, and these show a close relationship with the forms in the overlying Willowvale. Graptolites are common and are represented by *Monograptus clintonensis* and *Retiolites venosus.* The coral *Palaeocyclus rotuloides,* is abundant. *Chonetes cornutus, Dalmanella elegantula, Leptaena rhomboidalis* and *Spirifer radiatus* are the most common brachiopods. The trilobites, *Dalmanites limulurus* var. *lunatus* and *Liocalymene clintoni,* occur in considerable numbers. Ostracods of the *Mastigobolbina typus* zone are well represented by *Plethobolbina typicalis, M. typus* and *M. trilobata.* A few individual specimens of *Dibolbina* n. sp. and *Beyrichia* aff. *lakemontensis* have also been collected, but they are comparatively rare.

Origin. In its origin the Westmoreland is certainly connected with the deposition of the Williamson and the Irondequoit (p. 83). It apparently formed in a zone to the west in which the Williamson and possibly even some parts of the Irondequoit were forming. To the east beach conditions prevailed. Thus the Westmoreland appears to be directly connected with the eastward advance of the Upper Clinton sea.

Willowvale Shale

Definition. The Willowvale is introduced as a designation for those rocks which occupy a position between the Westmoreland (oolitic iron ore) and the Kirkland (red flux iron ore). The type locality of the Willowvale is on a small tributary flowing eastward into Sauquoit creek at the village of Willowvale (section 34, p. 171). The shale is well exposed underneath the Kirkland which forms the cap rock of a small falls at the top of a steep ravine or glen approximately 2000 feet west of the main village street.

Extent and lithologic characteristics. At the type locality the Willowvale (section 34, p. 171) is about 22 feet thick and consists

of a uniform, dark gray to purple, thin-bedded shale which is highly fossiliferous. The upper three feet of the formation is more calcareous than the underlying rock and has a slightly different color being a bluish gray. This portion is very fossiliferous but the specimens are fragmentary and appear to have been crushed and broken. There are a few thin limestones, and most of these are composed almost exclusively of the coral, *Palaeocyclus.*

A few miles to the west at Clinton (section 33, p. 169) the Willowvale exhibits the same lithology and has about the same thickness. At this point however the Dawes sandstone occupies a position between the top of the Willowvale and the base of the Kirkland. Between Clinton and Lakeport, a distance of 21 miles, the Willowvale merges with the Irondequoit and Williamson formations. The deposits have been previously discussed (see figure 12, p. 81).

To the east of the type section the formation extends into Herkimer county. It finally fades into and interfingers with a beach sandstone.

Both the lower and upper contacts of the Willowvale are sharp and well defined. No stringers of hematite reach upward into the formation from the underlying Westmoreland. Even where the ore is argillaceous there appears to be no gradation. As abrupt as the change is, no evidence of an unconformity was observed. The upper limits are even more clearly marked, and the Willowvale is separated from the overlying formations by an erosional unconformity.

Fauna. The Willowvale has a rich and varied fauna. The graptolites, *Monograptus clintonensis* and *Retiolites venosus,* which are so characteristic of the Williamson, occur in considerable numbers throughout the Willowvale. A few dendroid graptolites are also represented. True corals are much in evidence, and some layers are composed of *Palaeocyclus rotuloides. Chaetetes lycoperdon* is another common species. The bryozoans are a very prominent class. *Ceramopora imbricata, Rhinopora verrucosa, Eridotrypa striata* and *Chasmatopora asperatostriata* are among the more dominant species. Brachiopods are present in great numbers. A partial list of the common species includes *Coelospira sulcata, Dalmanella elegantula, Sowerbyella transversalis, Chonetes cornutus, Bilobites biloba, Atrypa reticularis, Camarotoechia neglecta, Schuchertella subplana, S. tenuis, Stropheodonta profunda, Spirifer radiatus* and *S. niagarensis.* The pelecypods are particularly abundant throughout the formation. *Pterinea emacerate, Leptodesma rhomboidea* and *Cuneamya alveata* are three of the most common forms. The cephalopod, *Dawsonoceras annulatum,* and the trilobites, *Liocalymene clintoni* and *Dalmanites limulurus,* are found in considerable numbers.

The microfauna is equally well developed in the Willowvale. The ostracods include *Plethobolbina typicalis, Beyrichia* aff. *lakemontensis, Mastigobolbina typus, M. trilobata* and *M. punctata.* The above listed forms are found in every outcrop of the formation. *Dibolbina n. sp.* is rare, but it has been found in the basal portion in the outcrops of the formation at the village of Clinton.

It will be noted that the species common in the Willowvale include most of the fossils which are characteristic of the Williamson and the various parts and facies of the Irondequoit farther to the west. As a whole the abundance of pelecypods is the only characteristic addition, and all of those species listed have been sparingly found in the shaly phase of the Irondequoit in Wayne and Cayuga counties.

Most of the fossils in the Willowvale are preserved as natural casts. In the upper three feet of the formation at Willowvale the fossils are fragmentary and hard to determine specifically. Throughout the rest of the formation the fossils are easily identified.

Origin. The Willowvale was unquestionably deposited in the same Upper Clinton sea that was responsible for the Williamson and the Irondequoit. The actual conditions of sedimentation must have been quite different from those existing where the other two formations were being deposited. Although it is a shale its lithology is not like that of the Williamson. It is thin-bedded but neither platy nor fissile. The thin beds are not parallel as in the Williamson, and a large part of the Willowvale appears to be great jumbled masses of thinly laminated argillaceous material. It is dark gray to purple in color in contrast with the dark green to black. Furthermore it is not like the calcareous phase of the Irondequoit. It cleaves readily along the bedding planes and does not possess a crumbly, massive, calcareous nature, nor upon weathering does it become a sticky, yellowish clay so characteristic of the shaly phase of the Irondequoit. The only rock of western New York, which closely compares in lithology with the Willowvale is the thin shale layers between the crystalline limestones of the Irondequoit in Wayne county.

The fossils point to a unique condition or set of conditions. Graptolites are found intimately associated with corals, bryozoans, brachiopods, trilobites and pelecypods. In no other formation is there such a close relationship of distinctly different classes of fossils. The explanation of such an occurrence on the basis of ecology is extremely difficult. It may be that conditions alternated so rapidly in the area that the effect produced is misleading in that the fossils appear to have lived in the same environment whereas each actually thrived in surroundings particularly suited to the individuals. It is also pos-

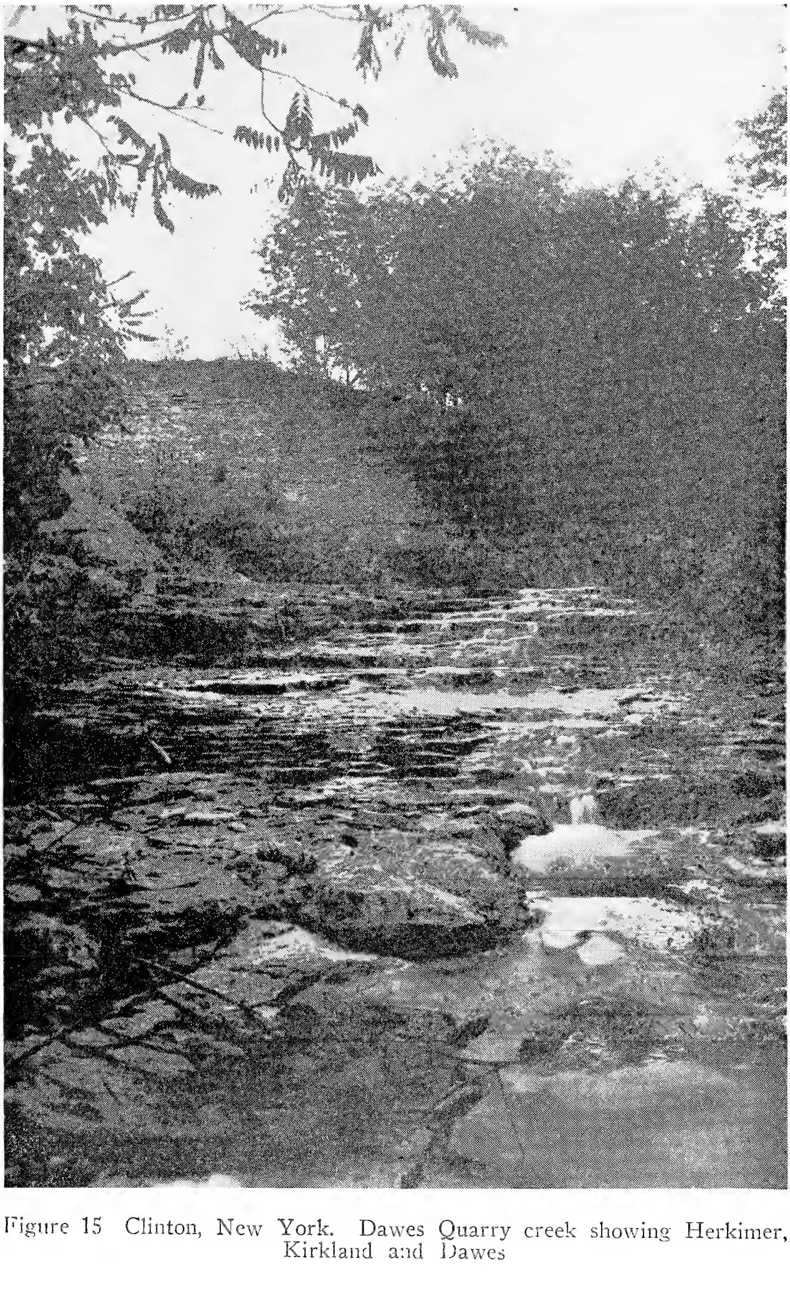

Figure 15 Clinton, New York. Dawes Quarry creek showing Herkimer, Kirkland and Dawes

sible that waves, currents and other forces at work within the sea may have mingled the forms requiring dissimilar environments. This may be an explanation for the peculiar bedding of the Willowvale.

Before the close of Irondequoit deposition in western New York it seems highly probable that marine conditions had already withdrawn from the eastern half of Oneida county, and that this area was undergoing active erosion. The effect of this period on the Willowvale shale is shown by the wavy upper surface upon which rests the Kirkland iron ore near the village of Willowvale. The fragmentary condition of the fossils in the upper part of the Willowvale at the type locality may be due to erosion and weathering. At Clinton the upper surface is very irregular, but there is no mass of broken and crushed fossils. The cross-bedded Dawes sandstone, however, occupies a position between the Willowvale and the Kirkland, and such a condition is in itself indicative of an unconformity. The rapid thinning of the beds westward away from the source of the clastics is still another strong argument in support of a period of erosion (figure 12, p. 81).

Dawes Sandstone

Definition. The Dawes sandstone is introduced as a designation for the light gray, slightly calcareous sandstone which underlies the Kirkland iron ore and overlies the Willowvale shale. The type locality is on a small stream locally known as Dawes Quarry creek flowing west into Oriskany valley within the limits of the village of Clinton. Previously this formation has been designated as the calcareous sandstone by Smyth ('95, p. 104) and by Ulrich and Bassler ('23, p. 346) as Bed No. 7 Upper Clinton.

Extent and lithologic characteristics: The Dawes sandstone measures approximately eight feet at the type locality (section 33, p 169). It consists of a very cross-bedded, light gray, slightly calcareous, unfossiliferous sandstone (see figure 15, p. 97). The sand grains range from very fine to coarse according to the Wentworth scale. In the basal portion are a few thin layers of arenaceous shales.

The Dawes sandstone has a very limited extent. It is not known to the west of College Hill creek on the west side of the Oriskany valley nor to the east of Dawes Quarry creek. If the Dawes could be included in another formation as a member, it would be highly desirable. An unconformity at the top and base of the formation together with the total absence of fossils makes it impossible to relate it to either the overlying or underlying formation.

Origin. The origin of the Dawes sandstone may be connected with the unconformity at the top of the Willowvale. It may have formed

as a local continental or semicontinental sandstone near the margin of the receding Upper Clinton sea. Possibly it represents a small delta deposit. Its lack of fossils and any semblance of uniform bedding tends to the conclusion that it is not a normal marine sandstone.

Rochester Shale

Definition. The Rochester was first named by Hall ('39, p. 290) for the typical exposures of this formation in the Genesee gorge. Later ('43, p. 80–84) he discarded the term, Rochester, and proposed to designate the strata as the Niagara shale. His reason for this shift was based on his conception of the Niagara group, which he believed should include two formations in western New York, the Niagara limestone (Lockport dolomite) and the Niagara shale (Rochester shale). Clarke and Schuchert ('99, p. 874–78) revived the title, Rochester shale, with its original meaning.

Extent and lithologic characteristics. The Rochester has a greater thickness and is better exposed than any other Clinton formation. From Niagara county on the west to Onondaga county on the east streams flowing northward from the area underlain by the more resistant Lockport dolomite, cut into the softer Rochester. Many of the outcrops thus uncovered, it is true, are fragmentary, but by piecing these together it is not difficult to obtain a fairly inclusive section within the radius of a few miles of any given point.

As a whole the Rochester is a dark bluish to brownish gray, calcareous, fossiliferous shale with argillaceous limestone layers. It changes somewhat from outcrop to outcrop, but it retains its characteristic color and its highly fossiliferous content throughout western New York. For this reason it has been correctly recognized as an important unit for more than a century.

In the Niagara gorge (section 1, p. 120) the Rochester is about 75 feet thick and can be roughly divided into two parts. The lower part is a bluish gray shale with numerous thin limestone layers. The calcareous shale itself is thin-bedded and very fossiliferous. The lower 10 feet of this division contains the famous crinoid horizon, but as a whole it is not so fossiliferous as the rock immediately overlying it. The upper four feet of this portion is a very calcareous shale with numerous, very thin limestone layers. Many of these limestones are made up almost exclusively of bryozoans. The upper half of the formation is less fossiliferous and tends to be brownish gray in color. Limestone layers are much less frequent, and the shale as a whole is not so calcareous. The upper 10 feet is more massive bedded than any other part of the Rochester and tests show that it is dolomitic as well as calcareous.

The outcrops in the vicinity of Lockport (section 2, p. 123) show that the Rochester has increased slightly in thickness (figure 16, p. 102). The lower 50 feet of the formation is a dark bluish gray shale with numerous limestone layers, most of which are argillaceous, but some are crystalline. The lower 15 feet are sparingly fossiliferous, but the rest of this portion of the Rochester abounds in fossils. At the top of this lower division are five feet of strata very rich in bryozoans. Ostracods are also very abundant and a few thin layers consist of little but their remains. The upper 25 feet of the formation is brownish gray with argillaceous limestones. This portion is dolomitic especially near the contact with the Lockport. It is quite possible that the dolomitic character of the shale was mistaken by some of the earlier geologists as indicating a siliceous content. The shale does contain some sand grains of silt size, but as a whole it is no more siliceous than layers occurring lower in the formation.

The Rochester at its type locality is about 85 feet thick. Except for the basal 10 feet which is brownish gray, it is dark bluish gray in color. The lower few feet and the upper 15 feet are relatively unfossiliferous, but the rest contains an abundance of fossils. In all but the lower 10 feet limestone layers are plentiful. The lower 25 to 30 feet of the formation is a weak shale, which upon being exposed quickly disintegrates into a blue to brown clay. The upper 20 to 25 feet is more massive-bedded and more resistant. Like the upper part of the Rochester to the west it is slightly dolomitic. Hartnagel ('07, p. 18) states that this portion of the formation was formerly quarried for building stone. Chadwick ('18, p. 360) gave it a separate designation, the Gates limestone.

To the east the Rochester increases rapidly in thickness (figure 16, p. 102) and in the vicinity of North Victory, Cayuga county, it reaches a maximum of about 140 feet along the line of outcrop. To the south in the vicinity of Clyde and Geneva it attains even a greater thickness as shown by well records. For a full discussion the reader is referred to an earlier publication (Gillette, '40, p. 88–94).

As far east as Wolcott the Rochester retains most of its lithologic characteristics. The lower 35 to 40 feet is a dark gray, calcareous shale with a few limestone layers. Except for the lower three feet, it is fossiliferous. This part is followed by a central portion which is highly calcareous but sparingly fossiliferous. It is dark gray to brownish gray in color. Limestone layers are particularly abundant at the top and are so resistant that they are often found forming the cap rock for small waterfalls. While it is similar in its more resistant character to the uppermost Rochester in Niagara and Monroe counties, it differs by having a very low magnesium content. The upper 35

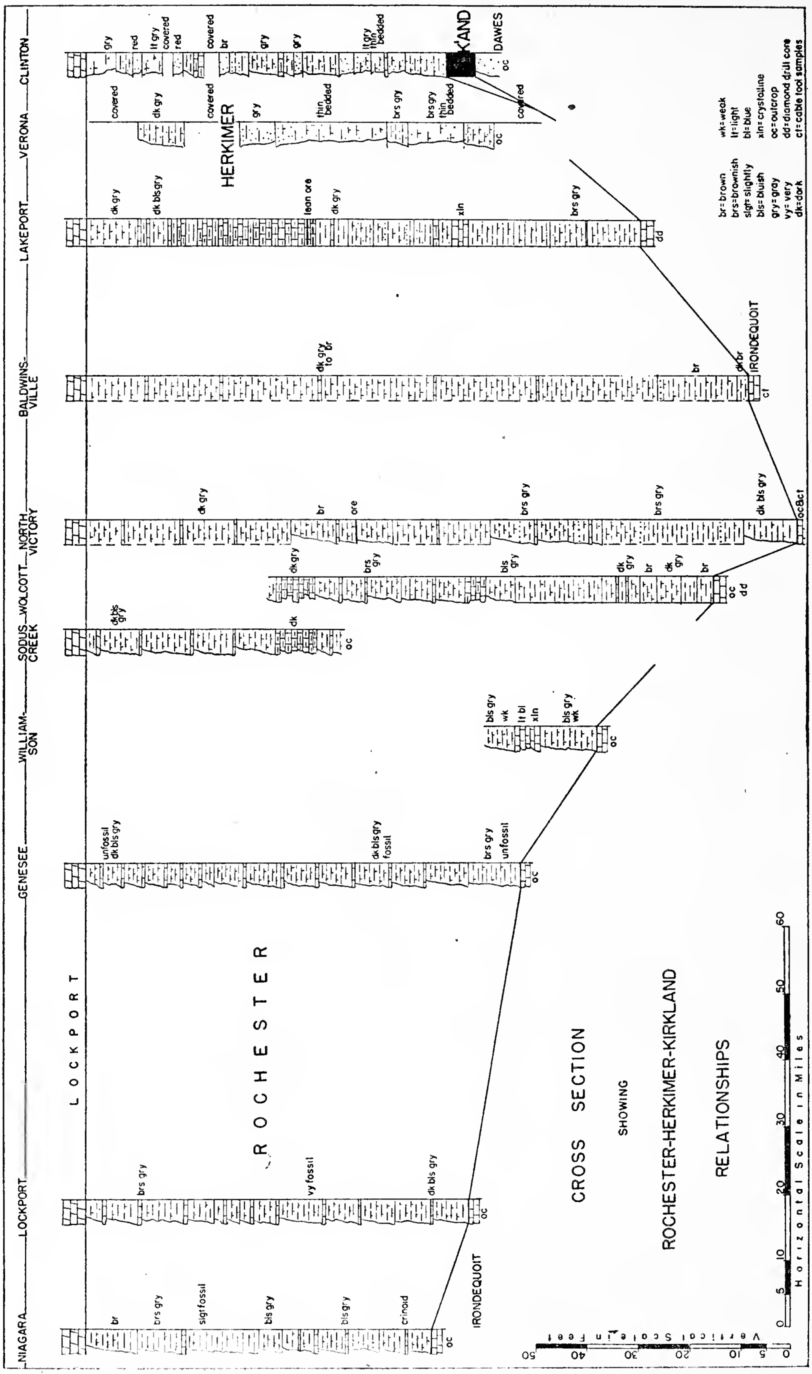

Figure 16 Cross section showing Rochester-Herkimer-Kirkland relationships.

feet (section 15, p. 146) of the formation is a bluish gray, calcareous shale with fewer limestone layers. This part is again highly fossiliferous, and the fossil bearing rock extends upward to the very contact of the Lockport. The upper five feet contain a few dolomitic layers.

The first real change in lithology is noted in the outcrops in the vicinity of North Victory, Cayuga county (section 22, p. 156). The lower 11 feet of the formation are the same dark brownish shale so characteristic of the Rochester of Wayne county. Samples from a cable tool well not far from North Victory show thin sandstone layers beginning to appear above these basal few feet. These thin sandstone layers are exposed in a fragmentary section located about 38 feet above the base of the formation. The sandstones are interbedded with typical brownish gray, highly fossiliferous, calcareous shales. The upper 80 feet of the formation contain no sandstone layers. A thin, lean iron ore, occupying a position 55 feet from the top of the formation, deserves special notice. This is the farthest west of any indication of concentration of hematite in the Rochester.

Between North Victory and Lakeport the outcrops of the Rochester are fragmentary. From gas well records in the vicinity of Baldwinsville it is possible to determine the thickness of the formation as 130 feet (figure 16, p. 102). The samples which were available were so widely spaced that the lithology could not be accurately determined. The diamond drill core at South Granby (section E, p. 180) in the same general area, shows that the lower 18 feet of the formation are a brownish gray, calcareous shale which is slightly sandy at the contact of the Irondequoit and contains a thin sandstone layer about 18 feet above the base.

In the Lakeport core (section G, p. 183) the lower part of the Rochester begins to assume a lithology approaching that of the Herkimer. The lower 65 to 70 feet of the formation is brownish gray in color with thin sandstone layers. The shale itself is less calcareous and is slightly sandy. The sandy character of the shale reaches downward to within a few feet of the base of the formation. Except in the basal few feet limestone layers are rare. The upper 45 to 50 feet of the formation more closely resemble the typical Rochester and is a dark bluish gray, calcareous shale. Limestone layers are abundant, and they increase downward. In fact at the base of this portion of the formation argillaceous limestones dominate the section. Immediately beneath these argillaceous limestones is a coarsely crystalline limestone with a few hematitic stringers.

The Rochester rests on the Irondequoit throughout western New York. The contact is always sharp and easily definable. The two formations always appear to be perfectly conformable, and there

is no evidence of any erosion between the deposition of the Irondequoit and the Rochester.

The Rochester is overlain by the Lockport dolomite and the upper limit is also easily determined. Whether an unconformity exists between the Rochester and the Lockport, particularly from the Genesee gorge westward, has been a source of controversy. Hall ('43, p. 106) and Hartnagel ('07, p. 22) agreed that the Rochester graded upward into the Lockport. Ulrich ('11, p. 28) found formations to the west which he considered to be intermediate in age between the Rochester and the Lockport. In order to make a place for these formations an unconformity of considerable magnitude was postulated between the Rochester and the Lockport of western New York. Grabau ('13, p. 470–71) claimed that such an unconformity was wholly unwarranted and that the Rochester of western New York passed upward into the Lockport without a break. Schuchert ('14, p. 277–320) gave a description of the outcropping sections in western New York and Ontario. Due largely to the westward thinning of the Rochester he believed that there was an unconformity between the Rochester and the Lockport which increased in magnitude especially west of the Niagara Gorge section. Chadwick ('18, p. 355–65) considered that there was evidence of an unconformity between the upper part of the Rochester which he called the Gates limestone and the overlying Lockport. He used this break as the upper boundary for his Eontaric.

In spite of all that has been written the writer believes that something can still be profitably said concerning the Rochester and Lockport boundary. No one can possibly place an unconformity between the Rochester and Lockport on Sodus creek (section 15, p. 146). At that place the Rochester grades into the Lockport through a transition zone at least two feet six inches thick. Because of construction the contact can not be studied in the Genesee gorge. In the Barge Canal section in the town of Gates (section 4, p. 126) the upper surface of the Rochester is slightly undulating as close observation reveals. There is, however, no trace of any truncation of bedding planes such as must accompany indisputable evidence of erosion. The bedding planes all parallel the upper surface. At Lockport there is most assuredly an interbedding of dolomitic layers with the typical Rochester shale. This transition zone is 18 inches thick and overlain by the DeCew member of the Lockport with its so-called enterolithic structure (Grabau '13, p. 470–71). The base of the DeCew in contact with the transition zone is slightly irregular but the real undulating surface occurs at the top of the DeCew immediately under the Gasport member. No one has even suggested placing an uncon-

formity at this point. In the Niagara section there does not appear to be any transition zone, and the upper surface of the Rochester is wavy. Again there is little if any evidence of a truncation of bedding. The upper surface of the DeCew beds is again much more irregular than the Rochester. In the Genesee gorge, Lockport and Niagara Gorge sections the upper part of the Rochester is dolomitic and in this respect is transitional between the calcareous shale below and the dolomite above.

A study of the contact reveals that the basis for an unconformity must rest wholly and entirely upon the westward thinning of the Rochester shale. This may be a rather weak argument. In the Geneva gas field about 22 miles south of the outcrop on Sodus creek the Rochester is 155 feet thick. Certainly there is no evidence that more than 20 feet of sediments have been eroded from the Sodus creek section. Furthermore the Rochester continues to thicken east of Sodus creek, and one would certainly expect an unconformity and not a transition zone if erosion is to explain the westward thinning.

Fauna. The fauna of the Rochester is the largest and by far the most diversified of all the Clinton formations. The lithology of the Rochester is such that perfectly preserved specimens can be easily broken from the fresh rock. Furthermore the fossils being more resistant than the inclosing shale are often found covering the outcrops, where they were left as the rock disintegrated. Because the Rochester is so fossiliferous and the specimens so well preserved, many famous collections have been made and described in the literature. The formation differs so greatly in lithology from the rocks underlying and overlying, that even the earliest reports on the fauna appear to be reliable.

The complete list of fossils collected at each locality from the Rochester is shown in the faunal tables (p. 18–21). Even these lists of fossils which include some rare as well as the common forms do not pretend to represent the complete Rochester fauna, but only those forms which were collected and identified by the writer.

Brachiopods are the dominant class of fossils. The most characteristic forms are *Dalmanella elegantula, Sowerbyella transversalis, Spirifer radiatus, S. niagarensis, Stropheodonta profunda, Schuchertella tenuis, Atrypa reticularis, A. rugosa, Leptaena rhomboidalis, Whitfieldella nitida, Camarotoechia neglecta, Rhipidomella hybrida* and *Dictyonella corallifera.* West of Wayne county bryozoans abound in the rocks of this formation. Bassler ('06) made a special study of these fossils and listed 84 species. In Wayne county and to the east bryozoans are less common. The three species most common are

Mesotrypa nummiformis, Ceramopora imbricata and *Chasmatopora asperatostriata.* In some parts of the formation trilobites are plentiful. *Dalmanites limulurus, Homalonotus delphinocephalus* and *Arctinurus nereus* are characteristic. Cephalopods are also common and *Dawsonoceras annulatum* was found in all but four outcrops. Pelecypods, gastropods, conularids sporadically occur in considerable numbers. Ostracods are well represented in the Rochester. A large number of species, many of which have never been described, are present. The outcrops in the vicinity of Lockport abound in this class of fossil. Only four species, however, appear to be common in sufficient numbers in widely separated outcrops to be of value in stratigraphic correlation. These are *Paraechmina spinosa, P. postica, Dizygopleura proutyi* and *Beyrichia veronica.*

Origin. Toward the close of the Irondequoit sedimentation there appears to have been a positive movement of the land mass to the east, the culmination of which brought to a close the clastic free Irondequoit deposition. This uplift not only caused the strand line to migrate westward in Rochester time, but the resulting higher land surface furnished a source for the argillaceous and clastic material which accounts for a large part of the Rochester. The argillaceous character of the Rochester is evident and needs no proof. The movement of the strand line westward is shown by the regressive overlapping of the nonclastic Irondequoit and the argillaceous Willowvale by the marine, beach and semicontinental sandstones of the Herkimer.

The source of most, if not all, of the clastics of the Rochester was probably the land mass to the east. This is shown by the indisputable fact that the sediments become coarser eastward. Furthermore the thickness of the Rochester diminishes westward from the center of accumulation. M. Y. Williams ('19, figure 11, p. 22) and Schuchert ('14, p. 277–320) show that this thinning continues in Ontario and that the Rochester pinches out near Kelso. This may suggest that there was no source of argillaceous material to the immediate west or north.

As already pointed out (p. 104) several eminent geologists have contended that the thinning of the Rochester westward is due to erosion. The writer has never visited the outcrops in Ontario, Canada, and some of the thinning is probably erosional. No great amount of the reduction in thickness westward within New York State, however, can be ascribed to this source (see p. 105).

From the nature of the sediments comprising the Rochester in the Lakeport core, it would seem that the land mass to the east became worn down toward the middle of the interval represented

by the deposition of that formation. Sandstones and sandy shales are confined to the lower half of the formation. This is also apparent to a lesser degree in the outcrops at Verona. The wearing down of the land mass and the filling in of that portion of the basin nearest the shore forced the sea westward toward the close of the Rochester. This is shown by the presence of continental sandstones in the upper portion of the Herkimer at Clinton and by the decided undulating and truncated upper surface of the Herkimer in Oneida county. The gradual process of wearing down and leveling of the land surface removed the source of argillaceous and clastic material. This helped set the stage for the formation of the extensive Lockport dolomite and other Niagaran limestone to the west and north.

Conditions were not uniform within the Rochester sea and the environment resulting from these various conditions undoubtedly had a great deal to do with the present distribution of the fossils. For example, intervals suitable to the growth and preservation of bryozoans were more frequent and of longer duration in Monroe, Orleans and Niagara counties than farther to the east. At times, particularly in Niagara county, the bryozoans were so plentiful that their remains formed the thin limestone layers. In Cayuga county and to the east they were able to exist as evidenced by the scattered fossils, but did not thrive in such numbers. The crinoid horizon in the Niagara gorge, the ostracod layers at Lockport, the *Whitfieldella nitida* layers of the Wolcott gorge, all appear to be the result of conditions which were suitable to the growth and preservation of individual classes and species. As a whole the Rochester seems to have been a time suited to a great variety of invertebrate life.

Kirkland Iron Ore

Definition. The Kirkland iron ore was named by Chadwick ('18, p. 349). It superseded the upper iron ore of Vanuxem ('42, p. 79–90) and the red flux iron ore of Smyth ('95, p. 104) and Newland and Hartnagel ('08, p. 27, 58–67).

Extent and lithologic characteristics. The Kirkland at Clinton (section 33, p. 169) is a fossiliferous hematic limestone. The concentration of hematite is low in comparison with the other iron ores of the Clinton. Much of the limestone is only barely stained although portions show a relatively high concentration. The fossils show all degrees of replacement varying from complete replacement to a thin coating of hematite. Some of the layers are crystalline with few fossils. In these latter the outer surfaces of some of the coarser crystals of calcite appear to be replaced; others seem to be only

stained a red color. A few siderite crystals were found. Certain layers are slightly sandy, but as a whole the formation is remarkably free of quartz, considering the fact that it is both underlain and overlain by a sandstone.

The Kirkland is extremely variable. On Dawes Quarry creek (section 33, p. 169) it measures about five and one-half feet. Across Oriskany valley on College Hill creek it is slightly over five feet, and there is a remarkable increase in the amount of wholly unreplaced limestone. At Willowvale (section 34, p. 171) it is roughly 54 inches thick. Here in spite of the fact that it contains argillaceous material, it shows a higher iron content and is more nearly comparable in general appearance with the fossiliferous iron ores of the Lower Clinton.

The lower limit of the formation is sharp. It is separated from the Dawes sandstone at Clinton and the Willowvale shale at Willowvale by an unconformity. In some spots the Dawes is stained red for a short distance below the contact, but this is apparently due to the weathering of the ore. The upper contact is not so well-defined. There are stringers and thin layers of ore reaching upward into the Herkimer. This can be seen in all the outcrops, but it is particularly evident on College Hill creek.

Fauna. Many layers of the Kirkland are very fossiliferous, but the number of species represented are few. Crinoid stems are by far the most abundant fossils. Numerically bryozoans rank next. *Cladopora fiberosa, Eridotrypa solida, Acanthoclema asperum* and *Fenestella elegans* are the most abundant species. The brachiopod, *Schuchertella subplana,* is common. The formation is apparently devoid of ostracods.

Origin. After the deposition of the Irondequoit and the Willowvale the Upper Clinton sea contracted (see p. 99). During this period the land surface to the east seems to have been rejuvenated and a depression of the geosyncline followed. As a result the sea again moved eastward into Oneida county.

The origin of the Kirkland is apparently connected with the eastward migration of the sea. The area now covered by the Kirkland appears to have become partly shut off from the rest of the sea. In this basin of limited extent hematitic limestone formed with only a minor amount of sand or other clastic material. Following the Kirkland sedimentation, another oscillation of the strand line brought about conditions suitable to the deposition of the overlying arenaceous shales and thin-bedded sandstones.

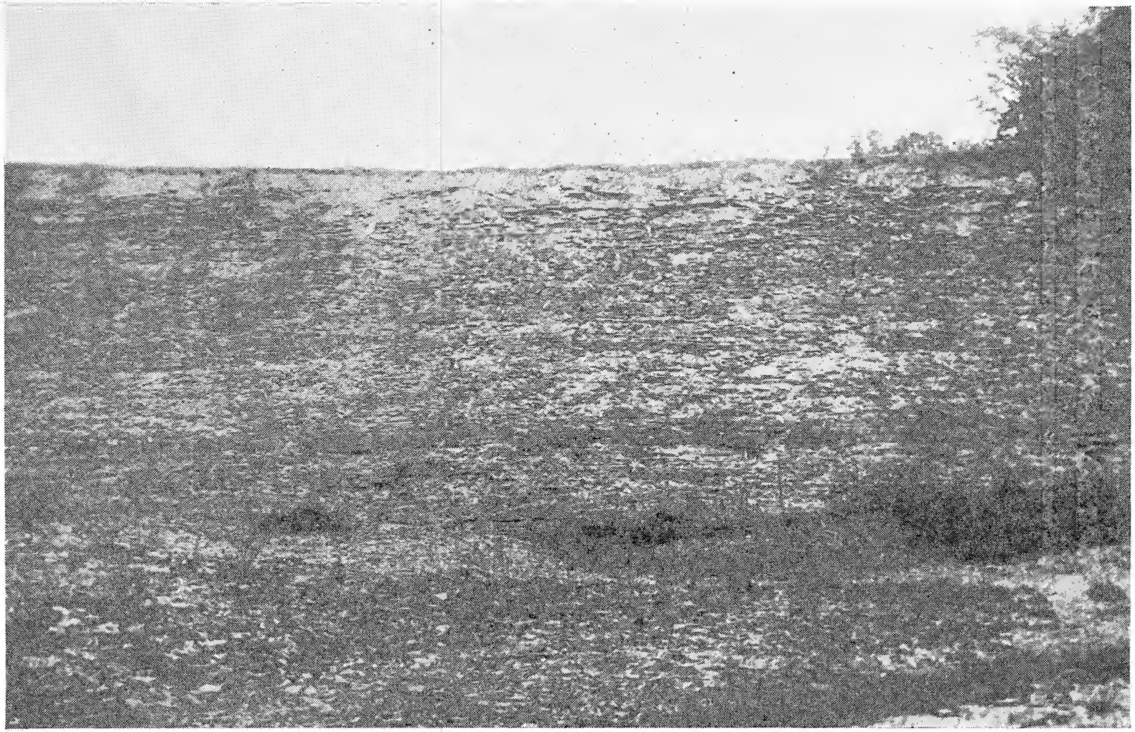

Figure 17 Clinton, New York. Herkimer sandstone. Dawes Quarry.

The prerequisite for the formation of an iron ore in the Upper Clinton, as in the Lower, appears to have been the establishing of a certain area within the sea suitable to their deposition. The marine waters of the Clinton seem always to have carried sufficient iron in solution, but certain definite conditions were required for its precipitation. The evidence of iron in the Rochester sea is shown not only by the Kirkland but by the thin lean ores of the Lakeport core (section G, p. 183) and the North Victory outcrops (section 22, p. 156).

Herkimer Sandstone

Definition. Chadwick ('18, p. 351) named the Herkimer from exposures of that upper sandstone formation of the Clinton in southern Herkimer county.

Extent and lithologic characteristics. The Herkimer outcrops on two creeks in the vicinity of Clinton. The entire thickness can be observed on College Hill creek (section 32, p. 167), but because so much of the lower part is covered only the upper half may be studied in detail. The lower portion of the formation is well-exposed on Dawes Quarry creek (section 33, p. 169) and in Dawes Quarry itself (figure 17, p. 109).

The Herkimer is approximately 75 feet thick. The lower half of the formation consists of about equal parts of gray, calcareous, thin-bedded sandstones and dark gray, sandy and silty, calcareous shales. Some of the sandstones are fossiliferous and definitely marine. Other sandstones show wave and ripple marks often accompanied by mud cracks. Except for a great variety of fucoids which Hall ('43, p. 69–79) and Vanuxem ('42, p. 79–90) described as marine plant remains, but which may be inorganic in origin, these beach sandstones are devoid of any evidence of past life. The calcareous shales and particularly the shale partings between the marine sandstones yield most of the fossils.

The upper part of the Herkimer as exposed on College Hill creek is made up largely of sandstones with minor amounts of sandy shale. Some of the sandstones are calcareous. A layer two feet thick near the center of the formation contains sufficient calcite to make it a sandy limestone. Another such layer occurs at the base of this upper part. The shales are always sandy and except near the base are non-calcareous. The sandstones are mostly gray in color but there are three thick layers or masses which are red and brown. The red and some of the gray layers are cross-bedded and unfossiliferous. The fossils are confined almost entirely to the more calcareous layers.

East of Clinton the Herkimer was studied at Willowvale (section 34, p. 171), but there was apparently no change in lithology in that short distance. Hasty observation farther to the east shows that the cross-bedded gray and red layers are more plentiful in eastern Herkimer county and completely dominate the section in the south central part of that same county.

West of Clinton the Herkimer not only thickens but its character also changes rapidly: At Verona (section 31, p. 164) the formation is at least 80 feet thick and probably nearer 90 feet. Cross-bedded gray and red sandstones are entirely absent. The formation consists of gray to brownish gray, calcareous, argillaceous, thin-bedded sandstones with interbedded sandy, calcareous shales of the same color. Farther to the west in the Lakeport core (section G, p. 183) the stratigraphic interval is occupied by beds which more closely resemble the Rochester shale than the Herkimer sandstone.

Fauna. In comparison with the Rochester the Herkimer fauna is meager. The marine sandstones and the more calcareous shales, however, do furnish a fair assemblage of identifiable specimens. Brachiopods and pelecypods are the classes best represented. The more common brachiopods are *Dalmanella elegantula, Camarotoechia neglecta, Stropheodonta profunda, Schuchertella subplana, Leptaena rhomboidalis, Atrypa reticularis* and *Spirifer niagarensis.* The most abundant pelecypods are *Pterinea emacerata, Modiolopsis subcarinatus* and *Leptodesma rhomboidea.* The cephalopod, *Dawsonoceras annulatum,* is a common fossil. The trilobites are represented by *Calymene niagarensis, Dalmanites limulurus* and *Homalonotus delphinocephalus.*

Ostracods are rare in the Herkimer and the few which are present are poorly preserved. They occur as natural casts in the shale between the more calcareous sandstones. The casts often are found to be made of fine sand and silt grains, and are easily broken. By collecting a large number of these poorly preserved specimens it was possible to identify the four species common to the *Paraechmina spinosa* zone. *Beyrichia veronica* was found in greater abundance than any other one species. In order of abundance the common forms are *Dizygopleura proutyi, P. postica* and *P. spinosa.* At Verona the ostracods are much more common than at Clinton and are much better preserved.

Origin. The Herkimer was deposited to the shoreward of the Rochester in the same sea. At times the actual shore line was located beyond the eastern boundary of Oneida county and marine shales and sandstones with their typical fossils were laid down in the Clinton-Willowvale area. At other times the strand line was in

Oneida county, and beach sandstones with their fucoids, mud cracks, wave and ripple marks were deposited. It would seem that at times the shore line was actually west of Clinton and that the red and brown and gray, cross-bedded sandstones formed under continental or at least semicontinental conditions.

The absence of any red sandstones and the presence of a few layers with mud cracks etc., tend to show that the area in the immediate vicinity of Verona was covered by the sea throughout the Herkimer. The great increase in the number of fossils also indicates that more nearly normal marine conditions prevailed. Before the close of Rochester deposition in the west or early in the sedimentation of the Lockport, marine conditions must have been absent from the vicinity of Clinton and to the east. This is shown by the presence of a marked unconformity at the top of the Herkimer and beneath the Lockport. How far the sea was forced westward and the agents of erosion were active is impossible to determine. The contact of the Herkimer and the Lockport is not exposed to the west of Clinton.

HISTORICAL GEOLOGY

LOWER CLINTON

The eastern half of the State at the beginning of Clinton time must have existed as a northward continuation of a large land mass of Appalachia, the main part of which lay to the south. This area which appears to have had considerable relief, was the source of most, if not all, the clastics of the Clinton. In contrast the western part of the State which had long been a part of the Appalachian geosyncline, was relatively near sea level with little relief.

A depression of the geosynclinal area in Clinton time brought marine waters into western New York. Ulrich and Bassler ('23, p. 267) recognized in Pennsylvania and elsewhere to the south a lower and older ostracod zone lying beneath the strata containing the *Zygobolba anticostiensis* assemblage, the *Z. excavata* zone of this report (p. 24). Since *Z. excavata* is the lowest and oldest ostracod zone represented in New York, it would appear that the sea migrated into the State from the south.

As the sea advanced it reworked the Grimsby and formed a thin but persistent mantle of Thorold sandstone throughout western New York (p. 29). The highly irregular argillaceous deposits of the Maplewood and the Neahga were probably also connected with this initial transgression (p. 37). The depression continued and the marine waters, becoming relatively clear, spread out far to the west moving the strand line beyond the boundaries of the State during the

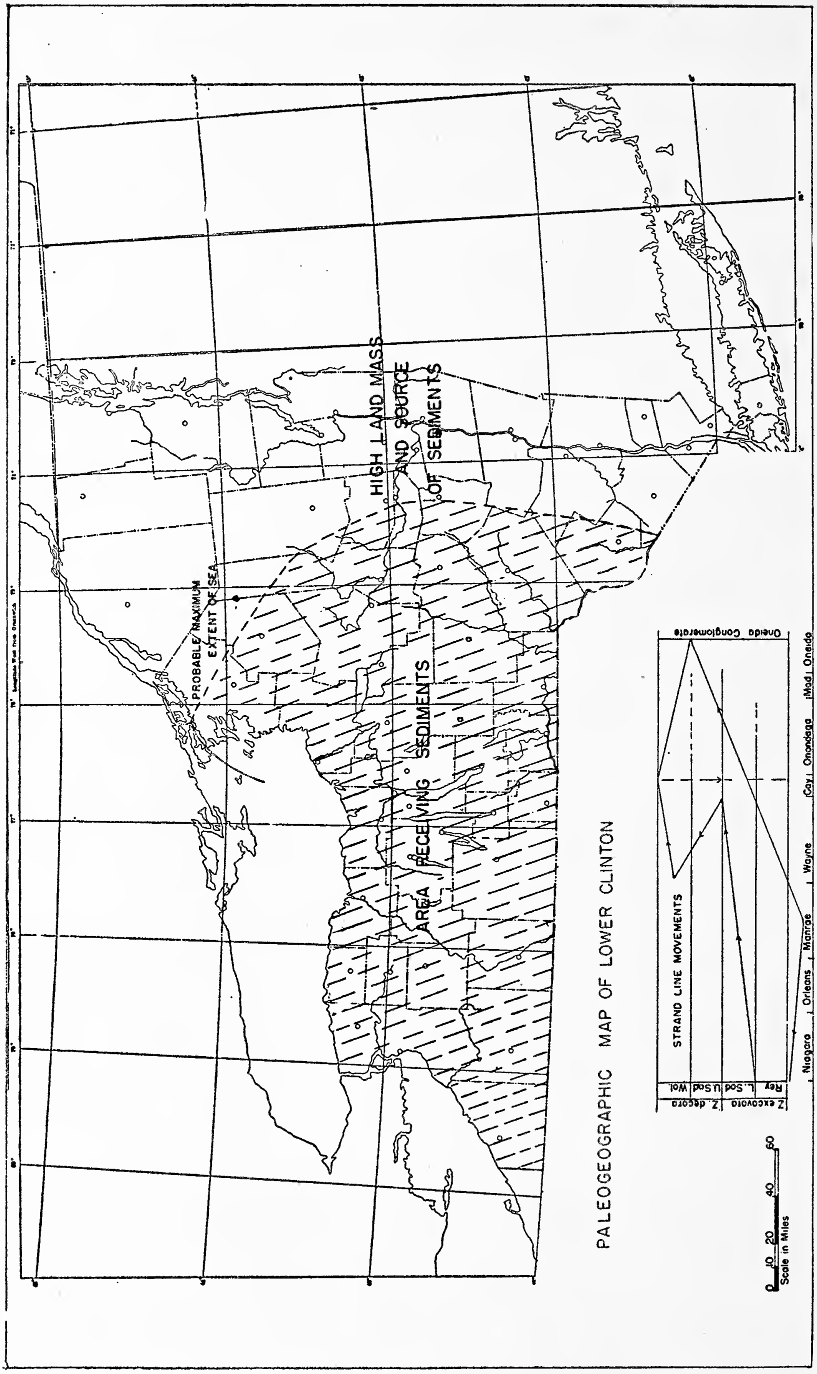

Figure 18 Paleogeographic map of Lower Clinton

deposition of the lowest Clinton limestone, the Reynales (figure 18, p. 114). To the east the sea had a more definite limit being bounded by a much higher land mass. Although the depression of the geosyncline permitted the seas to advance in that direction, the rate of migration was much slower. Furthermore, the clastic material derived from the adjacent land resulted in quite a different type of formation. In the immediate vicinity of the shore line the heavy sandy Oneida conglomerate formed. The lighter argillaceous material floated westward giving rise to the Bear Creek.

The strand line continued to move eastward through the deposition of the Lower Sodus (figure 18). The absence of any Lower Sodus west of Monroe county on the other hand indicates that the western strand line was forced eastward after the deposition of the widespread Reynales. This eastward migration of the western shore line may have been the result of a relative elevation of the western geosynclinal margin.

After the deposition of the Lower Sodus of Wayne county a relative elevation of the geosyncline may have caused a complete withdrawal of the sea from the State (p. 64). On the other hand the tilting which started in the Reynales may have continued in the Lower Sodus and forced the seas eastward into a relatively narrow trough in central New York (p. 65). The restriction of the area covered by the sea may explain the change from the limestones of the Reynales to the calcareous shales of the Lower Sodus.

During the Upper Sodus the sea again spread westward as well as eastward. This resulted in the deposition of the Upper Sodus unconformably on the lithologically similar Lower Sodus in Wayne county. Gradually the marine waters became free from sediment and the Upper Sodus gave way to the Wolcott. Soon after the beginning of Wolcott sedimentation both the eastern and western strand lines started to contract (figure 18, p. 114). At the close of the Wolcott the Lower Clinton sea was forced completely from New York into the deeper part of the geosynclinal area which seems to have lain to the south (p. 78).

MIDDLE CLINTON

The removal of the sea from western New York at the close of the Lower Clinton was probably accompanied by a general elevation which not only raised the geosyncline but also rejuvenated the land surface to the east and to the southeast. The identically similar lithology of the Oneida containing thin shales with ostracods characteristic of the Middle Clinton, and the same formation farther west with the Lower Clinton ostracods is substantial proof that the two divisions probably

derived their sediments from the same Appalachia. Furthermore the comparable size of the pebbles making up the coarser layers of both suggests that this land had a similar rugged relief.

Since there are no sediments of Middle Clinton age in western New York, that area probably existed as a land mass. The fact that the Lower Clinton is nowhere deeply eroded suggests that this land had a low elevation with only slight relief.

Marine conditions did not return even to central New York until well into the Middle Clinton (p. 78). The relatively narrow area, occupied by the Middle Clinton sediments along the line of outcrop, shows that the sea must have been confined to a narrow portion of northern central New York. The presence of a complete sequence of Lower and Middle Clinton formations in central Pennsylvania (F. M. Swartz, '34, p. 81–133 and Ulrich and Bassler, '23, p. 352–64), however, may indicate that the sea covered a much wider area in southern New York (figure 19, p. 117). It is possible that the deposits in northern central New York were formed in an indentation of the more general curving northern shore line whose exact position can only be a matter of conjecture.

The maximum development of the Middle Clinton is in eastern Oneida county. This suggests that that area may have been the first inundated. The sea spread westward as far as Cayuga county. This section is relatively thin and less clastic indicating that little or no sediment was derived from western New York. To the east the Middle Clinton overlaps the Lower Clinton deposits and rests directly upon the underlying Ordovician. This points to the conclusion that the land mass to the east and south was gradually being cut into and worn down. Marine conditions must have reached as far east as eastern Herkimer county.

After the deposition of the Sauquoit the sea was again forced southward into the deeper parts of the geosyncline. This may have been accomplished as a result of filling in the basin occupied by the marine waters. There is little or no evidence of any general elevation either in the uppermost Middle Clinton sediments themselves, or in the amount of erosion which they underwent before the advent of the Upper Clinton seas.

UPPER CLINTON

Erosion which had been acting upon the continuation of Appalachia in eastern New York since the beginning of the Silurian had succeeded by Upper Clinton time in wearing it down to one of only moderate relief. The absence of any coarse conglomerates in the Upper Clinton of central New York at least tends toward this conclusion.

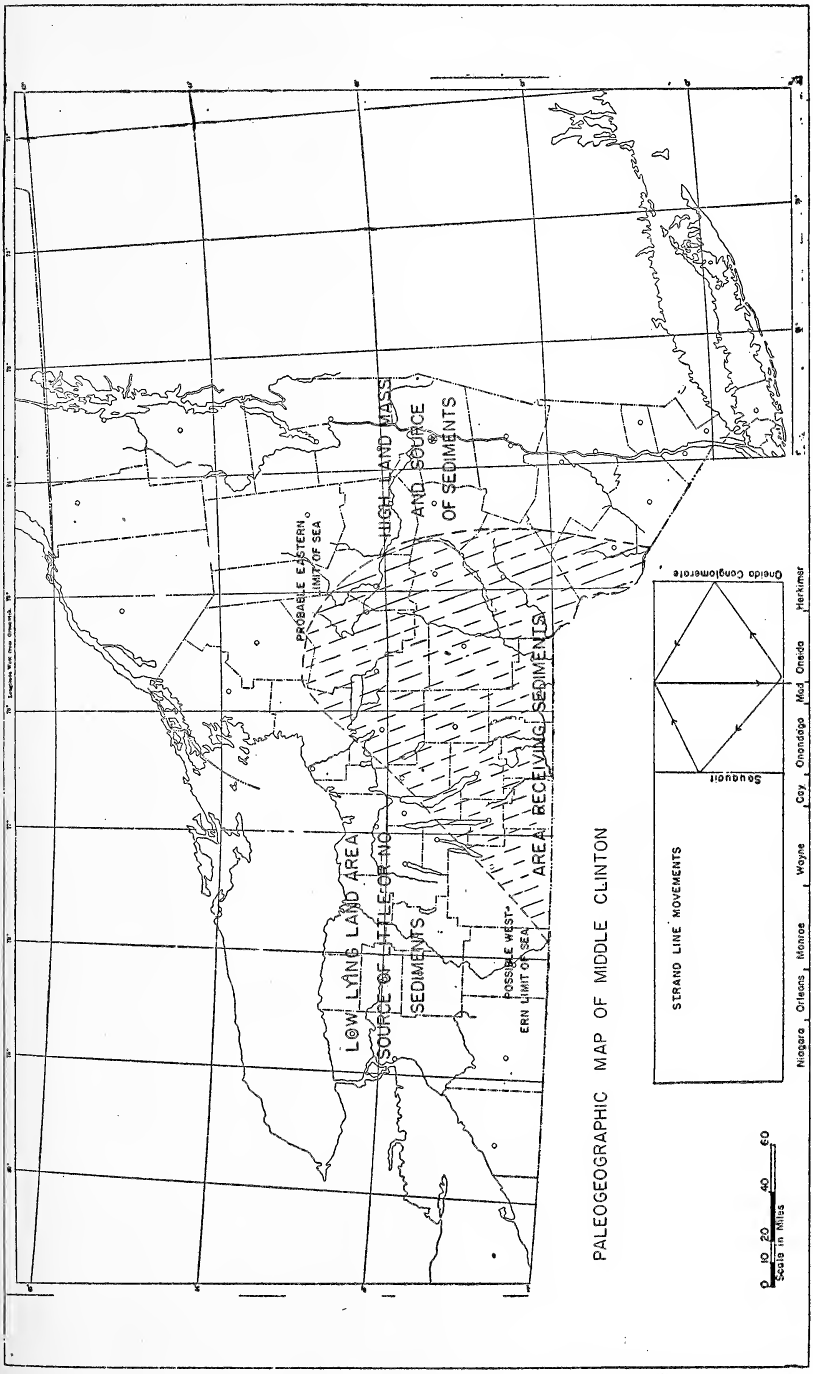

Figure 19 Paleogeographic map of Middle Clinton

Farther to the south where lay the main part of Appalachia, conglomerates may have continued to form until the close of the Clinton (C. K. and F. M. Swartz, '30, p. 467–74 and '31, p. 621–62).

Western and central New York following the withdrawal of the Middle Clinton sea was subject to erosion. Evidences of this period are plentiful. Even so the total amount of rock carried and worn away does not appear to have been great. There are small but no great irregularities in the thickness of the Lower and Middle Clinton beds which can be directly attributed to erosion. This can be plausibly explained if it is assumed that the land was only slightly above sea level which condition would prevent rapid erosion.

Either a slight depression of the geosyncline or a slight rise in sea level brought marine conditions back to central New York. The path of invasion appears to have been through Madison county (p. 83). Into this Williamson sea of the Upper Clinton was carried much argillaceous material some of which may have formed as a residuum during the period of weathering which directly preceded. The geosyncline continued to sink, and the sea expanded westward and eastward, culminating in the relatively widespread submergence of Irondequoit time. At the height of the submergence the sea extended far beyond the western margins of the State, and true marine conditions existed as far east as Montgomery county. In the west clear limestones were formed. In the east argillaceous material contributed to the formation of shale and sandstones developed in the immediate vicinity of the shore. Even along the shore line no conglomerates formed.

Before the conclusion of Irondequoit sedimentation an elevation of the land mass and the neighboring part of the geosyncline forced the eastern strand line to recede as far as Oneida county (figure 20, p. 119). Erosion was quite active and the newly formed sediments were beveled (p. 99). What is more the rejuvenated land surface made available an abundance of coarser clastic material. The introduction of this material into the Upper Clinton sea brought to a close Irondequoit sedimentation.

At the beginning of Rochester time the western strand line was beyond the border of the state (figure 20). In central New York the strand line again migrated eastward. This eastward movement was accompanied by frequent oscillations, a fact attested to by the alternating marine and beach sediments (p. 112) in eastern Oneida county. Marine conditions appear to have extended as far east as southeastern Herkimer county.

Toward the close of the Rochester there was a definite retreat of the eastern strand line. This time it did not seem to have been accompanied by an elevation of the land mass. Possibly it was brought

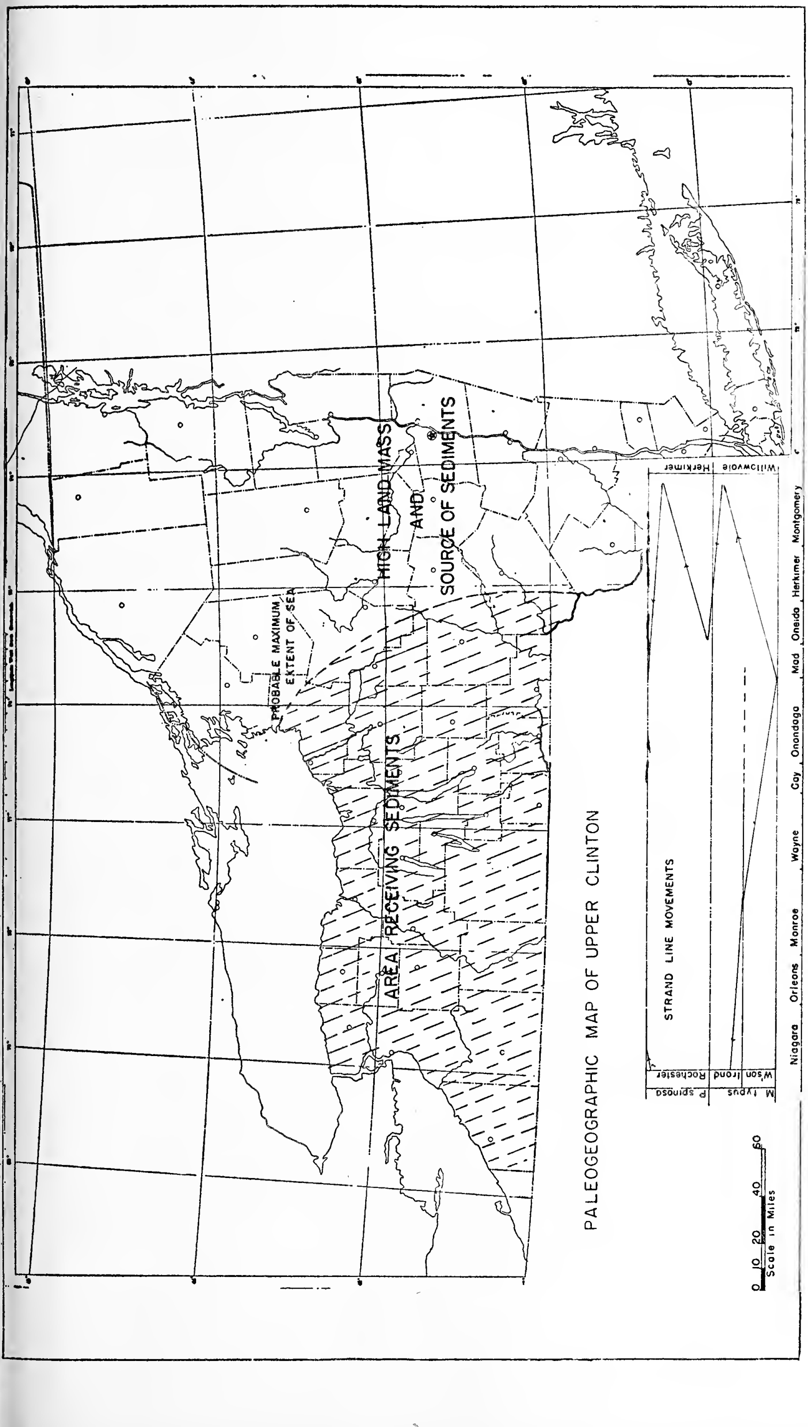

Figure 20 Paleogeographic map of Upper Clinton

about by the filling in of the geosyncline by both continental and marine sediments. The Upper Clinton sea was not entirely forced from New York. The termination of the Rochester and the Clinton is considered to have been brought about by a widespread general submergence which produced conditions necessary for Lockport sedimentation.

DESCRIPTION OF SECTIONS

More than fifty outcrop sections have been measured between the Niagara gorge and Willowvale. Thirty-four of these are necessary in understanding the stratigraphy of the Clinton and are described in the following pages. Location of sections is shown on map (figure 1, page 7).

NIAGARA GORGE SECTION 1

Towns of Lewiston and Niagara. County of Niagara. East side of Niagara gorge. Rochester is exposed in cliffs north of Niagara falls. Can be studied along the railroad which runs north from Lewiston along the base of the cliffs.

Top **Lockport**

80 ft.	Dark gray to dark brownish gray dolomite. Upper parts thin-bedded with bituminous partings. Sparingly fossiliferous.	Eight species identified

Upper Clinton Contact sharp

Rochester Shale

10 ft.	Brown to brownish gray, calcareous, dolomitic, massive shale. No resistant layers. Soft. Fossils rare.	No fossils collected
30 ft.	Bluish to brownish gray calcareous shale with thin limestone layers. Fossils rare.	*Leptaena rhomboidalis* *Strophonella striata* *Anastrophia interplicata* *Camarotoechia neglecta* *Pterinea emacerata* *Platyceras angulatum*
4 ft.	Bluish gray, very calcareous shale with numerous thin limestone layers. Limestone highly fossiliferous.	*Cladopora seriata* *Diploclema sparsum* *Ceramopora imbricata* *Fistulipora crustula* *Erdiotrypa striata* *Trematopora tuberculosa* *Chasmatopora asperatostriata* *Batostomella granulifera* *Fenestella elegans* *Semicoscinium tenuiceps*

		Lichenalia concentrica *Dalmanella elegantula* *Orthis flabellites* *Orthostrophia fasciata* *Rhipidomella hybridia* *Sowerbyella transversalis* *Camarotoechia neglecta* *Atrypa reticularis* *Trematospira camura* *Paraechmina spinosa* *Other ostracods*
20 ft.	Bluish gray, some brown-gray, calcareous shale with numerous limestone layers. Very fossiliferous with great diversity of fauna. Layers rich in fossils are interbedded with others practically barren.	*Enterolasma calculum* *Favosites hisingeri* *Dictyonema retiforme* *Ceramopora imbricata* *Chasmatopora asperatostriata* *Semicoscinium tenuiceps* *Lichenalia concentrica* *Pholidops squamiformis* *Dalmanella elegantula* *Orthis flabellites* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Strophonella patenta* *S. striata* *Schuchertella subplana* *Camarotoechia neglecta* *Rhynchotreta robusta* *Atrypa nodostriata* *A. reticularis* *Spirifer crispus* *S. niagarensis* *S. radiatus* *Whitfieldella cylindrica* *W. nitida* *W. nitida oblata* *Pterinea emacerata* *Diaphorostoma niagarense* *Platyceras angulatum* *Dawsonoceras annulatum* *Bumastus ioxus* *Dalmanites limulurus*
10 ft.	Bluish to brownish gray, calcareous shale with limestone layers. Contains famous crinoid beds, not so fossiliferous as overlying beds. Contact with underlying formation sharp.	*Caryocrinites ornatus* *Stephanocrinus angulatus* *Dalmanella elegantula* *Leptaena rhomboidalis* *Camarotoechia neglecta* *Conularia niagarensis*

Irondequoit Limestone

18 ft.	Light gray, some pink, crystalline **limestone.** Some layers composed of crinoid stems. Porous and brown to yellow when weathered. Fossil-	*Crinoid stems* *Leptaena rhomboidalis* *Stropheodonta profunda* *Rhynchotreta robusta* *Atrypa reticularis* *A. rugosa*

	iferous. Number of species limited. Toward the top very argillaceous reeflike limestone extends into base of overlying Rochester. Reef fossiliferous, but not examined closely.	*Whitfieldella cylindrica* *W. intermedia*

Lower Clinton — Unconformity

Reynales Limestone

4 ft.	Dark gray, fine grained, thin-bedded dolomitic limestone. Many of the layers are silty and argillaceous. Upper 12 inches dense and crystalline.	No fossils collected
5 ft.	Dark gray, dolomitic limestone, fine with coarse crystals imbedded in ground mass of fine material. Fossils rare.	*Buthotrephis gracilis* *Stropheodonta profunda* *Coelospira hemispherica*
3 ft.	Dark gray, very pyritic, phosphatic, finely crystalline, dolomitic limestone. Contact sharp with underlying formation.	*Stropheodonta corrugata* *S. profunda* *Coelospira hemispherica* *C. plicatula*

Neahga Shale

6 ft.	Smooth, slightly silty, slightly calcareous, thinly laminated, platy, green shale. Fossiliferous. Specimens poorly preserved.	*Buthotrephis gracilis* *Rhynchotreta cuneata americana* *Coelospira hemispherica* *C. plicatula* *Cuneamya alveata* *Pterinea emacerata* *Holopea obsoleta* *Tentaculites minutus* *Zygobolba curta* *Z. excavata*
1 ft.	Silty, sandy, green shale, thin-bedded, but not platy or smooth. Some layers calcareous. Some layers fine argillaceous sandstone. Fossils scarce and poorly preserved. Contact with underlying formation sharp.	*Coelospira hemispherica* *C. plicatula* *Holopea obsoleta*

Thorold Sandstone

6 ft.	Light gray, tightly cemented, argillaceous sandstone. Fine grained, argillaceous content not uniform. Cement silica, minor amount of carbonate. Unfossiliferous.	No fossils collected

Albion Group — Contact sharp

Grimsby Sandstone

50 ft.	Red sandstone	

LOCKPORT — SECTION 2

Town of Lockport. County of Niagara. West of the city of Lockport. Eighteen Mile creek. Stream has cut a deep gorge in the Clinton rock. Gorge called "The Gulf" on topographic map. Section measured is where road leading northwest from underpass at railroad crosses main branch of Eighteen Mile creek.

Top

Lockport

9 ft.	Gasport member. Pure, crystalline crinoidal limestone. Highly fossiliferous. Contact with underlying rock very sharp.	
7 ft.	Dark gray, argillaceous, fine-grained, dolomitic limestones. Only slightly fossiliferous.	

Upper Clinton — Contact slightly wavy

Rochester Shale

1 ft. 6 in.	Transition zone. Dolomitic limestone interbedded with dark dolomitic calcareous shale. Fossils rare.	*Dalmanella elegantula* *Orthis flabellites* *Sowerbyella transversalis* *Atrypa reticularis* *Dalmanites limulurus*
25 ft.	Brownish gray, calcareous and dolomitic shale with argillaceous limestone layers. Dolomitic content increased toward the top of formation. Compared with underlying slightly fossiliferous.	*Enterolasma caliculum* *Favosites pyriformis* *Striatopora flexuosa* *Dictyonema retiforme* *Chasmatopora asperatostriata* *Semicoscinium tenuiceps* *Lichenalia concentrica* *Pholidops squamiformis* *Dalmanella elegantula* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Strophonella striata* *Atrypa reticularis* *Spirifer niagarensis* *S. radiatus* *Whitfieldella nitida oblata* *Pterinea emacerata* *P. undata* *Diaphorostoma niagarense* *Homalonotus delphinocephalus* *Dalmanites limulurus*

20 ft.	Bluish gray, some brownish gray, calcareous shale with numerous limestone layers. Very fossiliferous particularly near top where thin limestones are composed almost entirely of ostracods or bryozoans.	*Enterolasma caliculum* *Cladopora seriata* *Favosites hisingeri* *Striatopora flexuosa* *Diploclema sparsum* *Ceramopora imbricata* *Coeloclema cavernosum* *Spatiopora maculata* *Fistulipora crustula* *Mesotrypa nummiformis* *Eridotrypa solida* *E. striata* *Chasmatopora angulata* *C. asperatostriata* *Semicoscinium tenuiceps* *Rhinopora verrucosa* *Pholidops squamiformis* *Dalmanella elegantula* *Orthis flabellites* *Orthostrophia fasciata* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Anastrophia brevirostris* *A. interplicata* *Dictyonella corallifera* *Camarotoechia neglecta* *C. obtusiplicata* *Rhynchonella bidentata* *Atrypa nodostriata* *A. reticularis* *A. rugosa* *Spirifer crispus* *S. niagarensis* *S. radiatus* *S. sulcatus* *Trematospira camura* *Leiopteria subplana* *Pterinea emacerata* *P. undata* *Amphicoelia orbiculoides* *Platyceras angulatum* *P. niagarense* *Dawsonoceras annulatum* *Bumastus ioxus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica and others*
20 ft.	Covered or poorly exposed. Apparently the same type of rock.	
10 ft.	Bluish to brownish gray, soft shale with some resistant argillaceous limestone layers. Fossils are comparatively rare but present. Contact sharp.	No fossils collected

Irondequoit Limestone

20 ft.	Light gray, coarsely crystalline, pyritic limestone. Some layers are composed of crinoid stems. Styolitic structures common. So-called reefs common in upper part and extends into the base of the overlying Rochester. Contact unconformable. Some poorly exposed.	In limestone Crinoid stems *Atrypa reticularis* *Spirifer niagarensis* *Whitfieldella cylindrica* *W. intermedia* In reefs *Dalmanella elegantula* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Strophonella patenta* *Anastrophia interplicata* *Camarotoechia neglecta* *Rhynchotreta cuneata americana* *Atrypa nodostriata* *A. reticularis* *A. rugosa* *Spirifer crispus* *S. niagarensis* *S. radiatus* *S. sulcatus* *Whitfieldella intermedia* *W. nitida* *W. nitida oblata* *Platyceras niagarensis* *Dawsonoceras annulatum* *Bumastus ioxus* *Calymene niagarensis* *Mastigobolbina trilobata* *M. typus* *Plethobolbina typicalis*

Reynales Limestone

10 ft.	Dark gray fine-grained dolomitic limestone. Lower 1 ft. 6 in. pyritic and phosphatic. Few thin fossiliferous layers above pyritic layers.	*Hyattidina congesta*

The lower part of the Reynales is best exposed along the side of the road which crosses the Gulf directly west of the city.

6 ft.	Dark gray fine-grained dolomitic limestone. Lower 2 ft. 6 in. pyritic and phosphatic. Thin light gray fossiliferous layer above the pyritic rock.	*Buthotrephis gracilis* *Stropheodonta corrugata* *Hyattidina congesta* *Coelospira hemispherica* *C. plicatula*

Thorold Sandstone

There are several fragmentary outcrops of Thorold in the area around Lockport. One of them shows the top to be not more than 8 to 10 inches below the lowest outcrop of the Reynales.

6 ft.	Light gray fine-grained argillaceous sandstone. Lightly cemented.	*Arthrophycus alleghaniensis*

Albion Group — Contact not observed

Grimsby Sandstone

Red sandstone

MIDDLEPORT — SECTION 3

Village of Middleport. Towns of Royalton and Hartland. County of Niagara. Outcrop located on a branch of Johnson creek. Rock is exposed in creek bed to north and south of Route 31.

Top

Lower Clinton

Reynales Limestone

4 ft.	Dark gray, fine-grained, dolomitic limestone. Fossils rare. Part poorly exposed.	*Hyattidina congesta*
8 ft.	Interstratified medium gray and dark gray, silty, dolomitic limestone. Some slightly cherty. Thin shale layers common. Fossiliferous.	*Buthotrephis gracilis* *Zaphrentis bilateralis* *Lichenalia concentrica* *Platystrophia biforata* *Rhipidomella circulus* *Stropheodonta corrugata* *S. profunda* *Rhynchotreta robusta* *Hyattidina congesta* *Coelospira hemispherica* *C. plicatula* *Holopea obsoleta* *Zygobolba curta* *Z. excavata*

GATES — SECTION 4

Barge Canal. Town of Gates. County of Monroe. The Barge canal is cut through the Rochester shale and the lower part of the Lockport from Lyell Avenue northward for about a mile. The following measured section is furnished by Dr H. L. Alling. Fossils personally collected and identified from the shale originally excavated from the canal. Therefore the exact horizon of the fossils is unknown.

Lockport

5 ft.	Dark gray even-bedded dolomite.
4 ft.	Dark gray, fairly evenly bedded dolomite.
12 ft.	Dark gray lenticular dolomite.
11 ft.	DeCew member. Argillaceous dolomite. "Curly" structure.

Upper Clinton — Contact unconformable (?)

Rochester Shale

Gates member of the Rochester 20 ft. Hard argillaceous limestone and calcareous shale.	*Enterolasma caliculum*
	Diploclema sparsum
	Coeloclema cavernosum
	Spatiopora maculata
Undifferentiated Rochester 20 ft. Thin - bedded, weak, brownish gray, thin-bedded shale.	*Chilotrypa ostiolata*
	Fistulipora crustula
	F. tuberculosa
	Mesotrypa nummiformis
	Batostomella granulifera
	Eridotrypa solida
	E. striata
	Lioclema asperum
	Trematopora tuberculosa
	Chasmatopora asperatostriata
	Pseudohornea diffusa
	Fenestella elegans
	Polypora incepta
	Semicoscinium tenuiceps
	Nematopora raripora
	Acanthoclema asperum
	Clathropora frondosa
	Pachydicta crassa
	Diamesopora dichotoma
	Stictotrypa punctipora
	Dalmanella elegantula
	Orthostrophia fasciata
	Bilobites biloba
	Leptaena rhomboidalis
	Sowerbyella transversalis
	Schuchertella subplana
	Dictyonella corallifera
	Camarotoechia neglecta
	Rhynchonella bidentata
	Atrypa reticularis
	Spirifer radiatus
	Homoeospira apriniformis
	Pterinea emacerata
	P. undata
	Hormotoma subulata
	Diaphorostoma hemisphericum
	D. niagarense
	Platyceras angulatum
	P. niagarense
	Orthoceras abruptum
	Arctinurus nereus
	Paraechmina spinosa

GENESEE GORGE SECTION 5

City of Rochester. County of Monroe. Maplewood Park, *west side of gorge*. Rock is exposed in cliff north of park proper. Follow path north of park. Path is on terrace formed by Reynales limestone.

Top

Upper Clinton

Irondequoit Limestone

10 ft. 6 in.	Light gray crystalline limestone. Average layer 6 in. thick. Some crinoidal weathers porous and yellow. Few shale partings. Upper part contains reef-like bodies.	Crinoid stems *Leptaena rhomboidalis* *Sowerbyella transversalis* *Atrypa reticularis* *Spirifer radiatus* *Whitfieldella cylindrica* *Dawsonoceras annulatum* *Mastigobolbina typus* *Plethobolbina typicalis*
8 ft. 2 in.	Crystalline limestone interbedded with dark grayish green shale layers. Predominantly limestone in upper part with shale partings. Lower part predominantly shale. Limestone layers thin. Shale beds are more fossiliferous. Gradual transition to underlying shale.	*Dalmanella elegantula* *Orthis flabellites* *O. tenuidens* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Stropheodonta profunda* *Clorinda fornicata* *Atrypa reticularis* *Spirifer radiatus* *Whitfieldella cylindrica* *W. intermedia* *Dawsonoceras annulatum* *Calymene clintoni* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Beyrichia aff. lakemontensis* *Dibolbina n. sp.*

Williamson Shale

5 ft. 7 in.	Dark grayish green fissile shale. In the lower part are many thin black layers, literally filled with graptolites. A few thin limestone layers in upper part. In lower part some graptolite layers have a central waferlike mass of calcareous material.	*Chaetetes lycoperdon* *Retiolites geinitzianus venosus* *Monograptus clintonensis* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Chonetes cornutus* *Scenidium pyramidale* *Clorinda fornicata* *Atrypa reticularis* *Hormotoma sulcatum* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Beyrichia aff. lakemontensis* *Dibolbina n. sp.*
0 to 2 in.	Shell rubble. Marks the contact between Upper and Lower Clinton. Consists largely of broken Coelospira and Stropheodonta shells. Few Lower Clinton ostracods found. Irregular upper surface often covered with Monograptus. Few calcareous pebbles found.	

Lower Clinton

Lower Sodus Shale

15 ft. 6 in.	Greenish gray shale with many thin layers of limestone interbedded. Dark gray or purple shale with green increases toward base of formation. Contact sharp. Limestone layers composed of Coelospira.	*Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Stropheodonta corrugata* *Coelospira hemispherica* *Ctenodonta machaeriformis* *Cyrtodonta alata* *Pterinea emacerata* *Holopea obsoleta* *Encrinurus ornatus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa* *Z. rectangula*

Reynales Limestone

7 ft.	Light gray limestone layers 6 in. to 1 ft. in thickness. Few thin shale partings. No apparent gradation. First Pentamerus layer 3 in. below lowermost Sodus. Second Pentamerus layer 2 ft. 4 in. from top. Third Pentamerus layer 3 ft. 10 in. from top. Fourth Pentamerus layer 6 ft. 5 in. from top.	*Favosites favosideus* *Cannopora junciformis* *Helopora fragilis* *Fenestella tenuis* *Semicoscinium tenuiceps* *Phaenopora ensiformis* *P. explanata* *Platyostrophia biforata* *Stropheodonta corrugata* *S. profunda* *Pentamerus oblongus* *Coelospira hemispherica* *Rhynchotreta robusta* *Phacops trisulcatus* *Zygobolba curta* *Z. excavata*

Rest of Lower Clinton exposed but cliff too steep to work details.

Brewer Dock Member of Reynales Limestone

East side of gorge. Rock exposed along road leading down to old landing on bank of river. Rock also outcrops south of the road leading down to Brewer's dock. By working both the rock to the south of the road and along the road the whole section of the Pentamerus may be obtained. The upper part of the limestone is poorly exposed. Only that part of the section which was not available on the west side is described here.

Top

Lower Clinton

Reynales Limestone

6 ft. 4 in.	Light gray crystalline limestone. This lower part is thinner bedded than the upper part. Many shale partings. Fifth Pentamerus layer occurs 8 ft. 9 in. from the top or 4 ft. 7 in. above iron ore. Sixth Pentamerus layer is only 4 in. above the ore. Contact sharp.	*Zaphrentis bilateralis* *Favosites favosideus* *Cannopora junciformis* *Chasmatopora angulatum* *Fenestella tenuis* *Helopora fragilis* *Phaenopora ensiformis* *Platystrophia lynx* *Stropheodonta corrugata* *Strophonella patenta* *Pentamerus oblongus* *Coelospira hemispherica* *Goldius niagarensis* *Zygobolba curta* *Z. excavata* *Z. prolixa*

Furnaceville Iron Ore

8 in. to 14 in.	Hematitic limestone commonly called "Iron Ore". Fossils replaced by hematite. Contact sharp.	Crinoid stems *Helopora fragilis* *Phaenopora ensiformis* Many other bryozoons *Stropheodonta corrugata* *Coelospira hemispherica* *Zygobolba excavata* *Z. prolixa*

Brewer Dock Member of Reynales Limestone

3 ft.	Light gray crystalline limestone with medium gray argillaceous, fine-grained, pyritic limestone. Thin-bedded, Some shale. Contact sharp.	*Phaenopora ensiformis* *P. explanata* *Stropheodonta corrugata* *Hyattidina congesta* *Coelospira hemispherica* *Bucania bellapuncta* *B. stigmosa* *Hormotoma subulata* *Cyclora subulata*

Maplewood Shale

20 ft. 6 in.	Smooth, platy, green shale. Near base becomes sandy and glauconitic. Contact not well-defined. Fossils rare.	No fossils collected

Thorold Sandstone

5 ft.	Gray sandstone. Very hard and well-cemented. Fine-grained silt size material abundant.	*Arthrophycus alleghaniensis*

Albion Group — Contact sharp

Grimsby

Red sandstone

DENSMORE CREEK SECTION 6

Town of Irondequoit. County of Monroe. Densmore creek crossed by Norton street. Rock outcrops at bridge and to the south of bridge. North of bridge is a small fault.

Top

Upper Clinton

Rochester Shale

13 ft. 10 in.	Dark bluish gray shale. Some very calcareous layers. Fossils very abundant.	*Enterolasma caliculum* *Dictyonema subretiforme* *Diploclema sparsum* *Ceramopora imbricata* *Coeloclema cavernosum* *Chilotrypa ostiolata* *Fistulipora crustula* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Acanthoclema asperum* *Clathropora frondosa* *Diamesopora dichotoma* *Other bryozoans* *Dalmanella elegantula* *Orthis flabellites* *O. punctostriata* *Bilobites biloba* *Leptaena rhomboidalis* *Schuchertella subplana* *Stropheodonta profunda* *Strophonella striata* *Camarotoechia neglecta* *Rhynchonella bidentata* *Atrypa nodostriata* *A. reticularis* *A. rugosa* *Spirifer niagarensis* *S. radiatus* *S. sulcata* *Whitfieldella intermedia* *W. nitida* *Leptodesma rhomboideum* *Pterinea emacerata* *Amphicoelia orbiculoides* *Platyceras angulatum* *P. niagarense* *Dawsonoceras annulatum* *Tentaculites minutus* *Conularia niagarensis* *Bumastus ioxus* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*

Between Norton Street bridge and Densmore Road bridge there are no outcrops. Rock outcrops under the bridge and continues for some distance downstream.

Top

Lower **Clinton**

Reynales Limestone

4 ft.	Light gray crystalline limestone. Few shale partings.	*Zaphrentis bilateralis* *Favosites favosideus* *Chaetetes lycoperdon* *Chasmatopora angulatum* *Fenestella tenuis* *Semicoscinium tenuiceps* *Platystrophia lynx* *Rhipidomella circulus* *Stropheodonta corrugata* *Strophonella patenta* *Pentamerus oblongus* *Rhynchonella bidens* *Rhynchotreta robusta* *Coelospira hemispherica* *Zygobolba excavata*

Furnaceville Iron Ore

9 in.	Hematitic limestone, Hematite replaces the limestone. Pieces of partly replaced limestone common. Some as islands of unreplaced limestone in "Ore". Fossils dwarf and broken.	Crinoid stems *Chasmatopora angulata* *Stropheodonta corrugata* *Strophonella patenta* *Coelospira hemispherica* *Cyclora subulata* *Zygobolba curta*

Brewer Dock Member of Reynales Limestone

2 ft. 9 in.	Light gray crystalline limestone with a few shale partings. This limestone is found just under the cap rock of the little falls.	*Stropheodonta corrugata* *Rhynchotreta robusta* *Hyattidina congesta* *Coelospira hemispherica* *Bucania stigmosa* *Cyclora subulata* *Holopea obsoleta*

Maplewood Shale

14 ft. 8 in.	Smooth, green, platy shale. Black phosphatic nodules common in lower part. Fossils rare and poorly preserved. Fossils most plentiful in layer out cropping on stream bank 110 ft. below falls. Fossils found associated with phosphatic nodules. Basal part covered.	*Buthotrephis gracilis* *Lingula perovata* *Rhipidomella circulus* *Coelospira hemispherica?* *Coelospira plicatula* *Pterinea (emacerata?)* *Holopea obsoleta*
8 ft.	Missing or too poorly exposed for study.	

Albion Group — Contact sharp

Grimsby Sandstone

Red sandstone

GLEN EDYTHE — SECTION 7

Town of Webster. County of Monroe. East side of Irondequoit bay. Small creek flowing into Irondequoit bay. Some rock is exposed along the road leading to Glen Edythe. Best outcrop in stream bed.

Top

Lower Clinton

Reynales Limestone

4 ft. 6 in.	Light gray crystalline limestone. Thin-bedded. Few shale partings.	*Buthotrephis gracilis* *Zaphrentis bilateralis* *Chaetetes lycoperdon* *Helopora fragilis* *Phaenopora ensiformis* *Rhipidomella circulus* *Stropheodonta corrugata* *Strophonella patenta* *Pentamerus oblongus* *Rhynchonella emacerata* *Rhynchotreta robusta* *Coelospira hemispherica* *Encrinurus ornatus* *Zygobolba prolixa*
1 ft.	Limestone. Light gray, crystalline, very fossiliferous. Probable Furnaceville horizon of Genesee gorge.	*Stropheodonta corrugata*
3 ft.	Light gray, crystalline, pyritic limestone. Some dark gray, argillaceous limestone. Shale partings common. Contact sharp.	*Phaenopora ensiformis* *P. explanata* *Helopora fragilis* *Nematopora raripora* *Hyattidina congesta* *Coelospira hemispherica* *Hormotoma subulata* *Cyclora subulata*
15 ft. 2 in.	Smooth, green, platy, slightly calcareous shale. Sandy with phosphatic nodules near base. Contact clearly defined.	No fossils collected

Thorold Sandstone

3 ft. 4 in.	White sandstone. Imbedded in the sandstone layers are small pebbles of shale.	*Arthrophycus alleghaniensis*

Albion Group — Contact clearly defined

Grimsby Sandstone

50 ft.	Red sandstone

FRUITLAND ORE PIT SECTION 8

Town of Ontario. County of Wayne. One mile north of Fruitland on the Fruitland-Lakeside road. Exposure 1150 ft east of road in the open cut ore pits. The only iron ore mine operating in Wayne county at the present time.

Top

Lower Clinton

Reynales Limestone

1 ft. 11 in.	Light gray, crystalline, slightly cherty limestone. Fossils and especially the Pentamerus are slightly silicified.	*Zaphrentis bilateralis* *Fenestella tenuis* *Chasmatopora angulata* *Stropheodonta corrugata* *Pentamerus oblongus* *Coelospira hemispherica*
4 ft. 4 in.	Light gray limestone, Argillaceous limestone common. Some thin sandy layers. Ostracods are very common. Some are well-preserved.	*Zaphrentis bilateralis* *Favosites favosideus* *Fistulopora tuberculosa* *Chasmatopora angulata* *Fenestella tenuis* *Semicoscinium tenuiceps* *Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Dalmanella elegantula* *Platystrophia biforata* *Rhipidomella circulus* *Stropheodonta corrugata* *S. profunda* *Rhynchotreta robusta* *Coelospira hemispherica* *Tentaculites minutus* *Goldius niagarensis* *Encrinurus ornatus* *Homalonotus n. sp.* *Phacops trisulcata* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa* *Z. rectangula*

Furnaceville Iron Ore

1 ft. 6 in.	Hematitic limestone. Dominantly a fossil ore but oolitic form common. Contact sharp.	*Zaphrentis bilateralis* Crinoid stems *Helopora fragilis* *Phaenopora constellata* *P. ensiformis* *P. explanata* *Stropheodonta corrugata* *Strophonella patenta* *Coelospira hemispherica* *Hormotoma subulata* *Cyclora subulata* *Encrinurus ornatus* *Zygobolba curta* *Z. excavata* *Z. prolixa* *Z. rectangula*

Thorold Sandstone

6 in.	Gray sandstone with shale pellets imbedded in the sandstone. The top layer contained phosphatic nodules. The whole thickness is not present. Ore is frozen to top of gray sandstone. Thickness exposed on creek near-by.	No fossils collected

FISH CREEK — SECTION 9

Town of Ontario. County of Wayne. Outcrop is a short distance north of United States Highway 104 in stream bed near old mill.

Top

Lower Clinton

Wolcott Limestone

6 ft. 2 in.	Light gray, crystalline limestone. Toward the base the limestone becomes thin-bedded. Shale and limestone interbedded. Contact transitional.	*Favosites favosideus* *F. pyriformis* *Chaetetes lycoperdon* *Chasmatopora angulata* *Fenestella tenuis* *Semicoscinium tenuiceps* *Rhinopora verrucosa* *Platystrophia biforata* *Leptaena rhomboidalis* *Pentamerus oblongus* *Rhynchotreta robusta* *Strophostylus cancellatus* *Zygobolba decora* *Mastigobolbina incipiens* *M. retifera*

Upper Sodus Shale

3 ft. 2 in.	Green shale with limestone layers. Apparent transition between limestone and shale.	*Helopora fragilis* *Phaenopora ensiformis* *Nematopora raripora* *Stropheodonta corrugata* *Rhynchotreta robusta* *Coelospira hemispherica* *Zygobolba decora* *Z. robusta* *Mastigobolbina incipiens* *M. retifera*

SALMON CREEK WEST — SECTION 10

Town of Williamson. County of Wayne. The outcrops start 175 feet north of United States Highway 104 and continue intermittently to the railroad bridge (Rome, Watertown and Ogdensburg Division of the New York Central). The outcrops are deeply weathered. This is the type locality of the Williamson shale.

Top

Upper Clinton

Rochester Shale

9 ft. 6 in.	Brownish gray shale with limy layers. Very fossiliferous contact not observed, but fragments of this shale in bank just above following limestone.	*Enterolasma caliculum* *Zaphrentis turbinata* *Mesotrypa nummiformis* *Fenestella elegans* *Diamesopora dichotoma* *Dalmanella elegantula* *Leptaena rhomboidalis* *Orthis flabellites* *Schuchertella subplana* *Stropheodonta profunda* *Camerotoechia obtusiplicata* *C. neglecta* *Atrypa reticularis* *Spirifer radiatus* *Whitfieldella nitida* *W. nitida oblata* *Pterinea emacerata* *Amphicoelia orbiculoides* *Platyceras niagarense* *Dawsonoceras annulatum* *Bumastus ioxus* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*

Irondequoit Limestone

7 ft. 10 in.	Crystalline limestone. Shale partings are common. Outcrop in bank near site of old saw mill, 1175 ft. north of Route 104. Contact gradational.	*Leptaena rhomboidalis* *Atrypa nodostriata* *A. reticularis* *Whitfieldella cylindrica* *W. intermedia* *Mastigobolbina typus* *Plethobolbina typicalis*
8 ft. 4 in.	Crumbly dark bluish gray calcareous shale with some argillaceous limestone layers. Contact gradational.	*Dalmanella elegantula* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Clorinda fornicata* *Atrypa nodostriata* *A. reticularis* *Spirifer radiatus* *S. sulcata* *Whitfieldella cylindrica* *W. intermedia* *Pterinea emacerata* *Dawsonoceras annulatum* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Dibolbina* **n. sp.**

Williamson Shale

6 ft. 10 in.	Dark greenish gray fissile shale. Thin black layer near base.	*Enterolasma caliculum* *Dictyonema gracile* *D. retiforme* *Retiolites geinitzianus venosus* *Monograptus clintonensis* *Pholidops squamiformis* *Dalmanella elegantula* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Chonetes cornutus* *Scenidium pyramidale* *Rhynchonella bidens* *Atrypa reticularis* *Cyrtia meta* *Spirifer radiatus* *Ctenodonta machaeriformis* *Orthoceras bassleri (?)* *Calymene clintoni* *Beyrichia aff. lakemontensis* *Mastigobolbina punctata* ***M. trilobata*** *M. typus* *Dibolbina n. sp.*

Lower Clinton — Contact sharp

Wolcott Limestone

7 ft. 2 in.	Light bluish gray crystalline limestone with shale partings.	*Zaphrentis bilateralis* *Favosites favosideus* *Chaetetes lycoperdon* *Chasmatopora angulata* *Fenestella tenuis* *Platystrophia biforatus* *Pentamerus oblongus* *Leptaena rhomboidalis* *Rhynchotreta robusta* *Atrypa reticularis* *Coelospira hemispherica* *Zygobolba decora*

MINK CREEK — SECTION 11

Town of Williamson. County of Wayne. Outcrop is both north and south of United States Highway 104. From the highway the outcrop extends about 550 ft. to the north and about 900 ft. to the south.

Top

Upper Clinton

Rochester Shale

25 ft.	Brownish gray calcareous shale with some argillaceous limestone layers. Fossils are not abundant.	*Enterolasma caliculum* *Zaphrentis turbinata* *Fistulipora tuberculosa* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Dalmanella elegantula* *Orthis flabellites*

Leptaena rhomboidalis
Sowerbyella transversalis
Schuchertella subplana
Stropheodonta profunda
Camarotoechia neglecta
C. obtusiplicata
Atrypa reticularis
Spirifer niagarensis
S. radiatus
Whitfieldella nitida oblata
Pterinea emacerata
Dawsonoceras annulatum
Arctinurus nereus
Homalonotus delphinocephalus
Dalmanites limulurus
Paraechmina spinosa

Mink creek flows over glacial till for about one and a quarter miles. The next outcrop is located where Mink creek crosses second east-west road south of Lake Ontario. Rock occurs in the stream bed and along the banks on both sides of the road.

Lower Clinton

Reynales Limestone

5 ft. 6 in.	Dark to medium gray limestone. The highest layer contains some chert. There are a number of shale layers. Fossils silicified. Contact sharp. The highest layer outcrops 1150 ft. south of road. The lowest layer is 575 ft. south of road.	*Zaphrentis bilateralis* *Cannapora junciformis* *Stromatopora constellata* *Dimerocrinus brachiatus* *Rhinopora verrucosa* *Leptaena rhomboidalis* *Stropheodonta corrugata* *Pentamerus oblongus* *Rhynchotreta robusta* *Spirifer radiatus ?* *Coelospira hemispherica* *Strophostylus cancellatus* *Discosorus conoideus* *Zygobolba curta* *Z. excavata* *Z. prolixa* *Z. rectangula*

Furnaceville Iron Ore

9 in.	Hematitic limestone. Fossiliferous type. Fossils fragmentary. Some dwarf forms.	Crinoid stems *Helopora fragilis* *Phaenopora constellata* *P. ensiformis* *P. explanata* *Coelospira hemispherica* *Tentaculites minutus*

Thorold Sandstone

2 ft. 6 in.	Covered.	
1 ft. 6 in.	Gray sandstone with embedded green shale pellets. Outcrops just under bridge.	*Arthrophycus alleghaniensis*
2 ft. 5in.	Covered.	

Albion Group

Grimsby Sandstone

	Red sandstone. First outcrop of this formation is 85 ft. north of bridge.	

Weed Creek — Section 12

Town of Sodus. County of Wayne. Outcrop is located south of the Lake road on creek which is locally known as Weed's creek. It is the first stream flowing into Lake Ontario east of Nigger Hill, shown on the topographic map. Outcrop is on the eastern branch of that creek.

Top

Lower Clinton

Reynales Limestone

5 ft. 2 in.	Dark gray to medium gray, cherty, sandy limestone. Very sandy with stringers of hematite near the base. Important because of abundance of chert and absence of bryozoans. Contact sharp and is located 300 ft. south of road.	*Zaphrentis bilateralis* *Favosites favosideus* *Cannapora junciformis* *Leptaena rhomboidalis* *Stropheodonta corrugata* *Pentamerus oblongus* *Rhynchotreta robusta* *Coelospira hemispherica* *Holopea obsoleta* *Goldius niagarensis* *Encrinurus ornatus* *Zygobolba curta* *Z. excavata* *Z. prolixa*

Furnaceville Iron Ore

8 in.	Hematitic limestone. Iron content very low. Phosphatic pebbles common. Fossils fragmentary and dwarf. Contact sharp.	*Helopora fragilis* *Phaenopora ensiformis* *Coelospira hemispherica* *C. plicatula*

Thorold Sandstone

4 ft. 3 in.	Gray sandstone with embedded clay pellets. The upper 4 in. is an olive-green sandy shale with phosphatic pebbles.	*Arthrophycus alleghaniensis*

Albion Group

Grimsby Sandstone

2 ft.	Red sandstone. Outcrop continues to road. More Grimsby is exposed north of Lake road.	

Salmon Creek East — Section 13

Town of Sodus. County of Wayne. Outcrop near the hamlet of Wallington where the east branch of Salmon creek is crossed by United States Highway 104. The outcrop extends to the south 225 ft. and to the north 975 ft. of the highway. See also page 175.

Top

Upper **Clinton**

Rochester Shale

21 ft. 6 in.	Brownish gray shale containing some argillaceous limestone and some thin crystalline fossiliferous limestone layers. Fossils are abundant and well-preserved.	*Enterolasma caliculum* *Favosites constrictus* *F. pyriformis* *Dictyonema retiforme* *Ceramopora imbricata* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Dalmanella elegantula* *Orthis flabellites* *Rhipidomella hybrida* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Camarotoechia neglecta* *Atrypa reticularis* *A. rugosa* *Spirifer crispatus?* *S. radiatus* *S. sulcata* *Whitfieldella naviformis* *W. nitida* *W. nitida oblata* *Pterinea emacerata* *Platyceras niagarense* *Cyrtoceras subcancellatum* *Dawsonoceras annulatum* *Bumastus ioxus* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Beyrichia veronica*

Salmon creek flows over till for about a mile and a half. Rock again appears in the stream bed 650 feet south of where the second east-west road south of Lake Ontario crosses the east branch of Salmon creek.

Lower Clinton

Upper Sodus Shale

10 ft.	Green, calcareous shale with limestone layers which are composed of Coelospira (pearly layers). Upper part is	*Helopora fragilis* *Phaenopora ensiformis* *Stropheodonta corrugata* *Coelospira hemispherica* *Tentaculites minutus*

	poorly exposed. Lower part is well-exposed. Contact, marked by an erosional unconformity, is 385 ft. north of bridge.	*Calymene senaria* *Calymenella rostrata* *Phacops trisulcata* *Zygobolba decora* *Z. intermedia* *Z. robusta*

Lower Sodus Shale

14 ft.	Green to greenish gray, calcareous shale with pearly layers, also dark gray or purple shale. Limestone more abundant in the upper part. Dark gray layers increase in abundance to the base.	*Phaenopora ensiformis* *Chaetetes lycoperdon* *Helopora fragilis* *Lingula perovata* *Rhynchonella emacerata* *Stropheodonta corrugata* *Coelospira hemispherica* *Pterinea emacerata* *Orthodesma curtum* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa* *Z. rectangula*
5 ft. 6 in.	Dark gray or purple shale. Thin limestones very rare. The whole section of Lower Sodus exposed either in the stream bed or in the banks along the stream. Contact sharp, located 3800 ft. below bridge.	*Helopora fragilis* *Phaenopora ensiformis* *Lingula perovata* *Stropheodonta corrugata* *Coelospira hemispherica* *Pterinea emacerata* *Orthodesma curtum* *Ctenodonta lata* *C. machaeriformis* *C. mactriformis* *Holopea obsoleta* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa* *Z. rectangula*

Reynales Limestone

15 ft.	Dark gray argillaceous limestone with medium gray crystalline layers in lower 8 ft. Upper 3 ft. thin-bedded with shale partings. Upper 7 ft. very cherty. Lower 3 ft. impregnated with hematitic layers. Pentamerus layers confined to basal part. Lowest layers covered by mill pond except in a dry season. Contact sharp, located 5100 ft. below bridge.	*Buthotrephis gracilis* *Zaphrentis bilateralis* *Favosites favosideus* *Cannapora junciformis* *Stropheodonta corrugata* *Pentamerus oblongus* *Rhynchotreta robusta* *Coelospira hemispherica* *Ctenodonta lata* *C. machaeriformis* *Pterinea emacerata* *Zygobolba curta* *Z. excavata* *Z. inflata*

Furnaceville Iron Ore

1 ft.	Upper 6 in. hematitic limestone. Lower 6 in. green shale with some oolites of hematite. Phosphatic nodules present. Contact sharp.	*Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Rhipidomella circulus* *Stropheodonta corrugata* *Coelospira hemispherica* *Holopea obsoleta* *Zygobolba curta* *Z. prolixa*

Thorold Sandstone

3 ft. 9 in.	Gray sandstone. Slightly calcareous with embedded clay pellets. Prominent closely spaced joints cause the sandstone to break in rectangular pieces.	*Arthrophycus alleghaniensis*

Albion Group

Grimsby Sandstone

20 ft.	Red sandstone

SECOND CREEK SECTION 14

Town of Sodus. County of Wayne. Hamlet of Alton. Rock outcrops for 250 ft. south of the bridge on United States Highway 104 and to the north as far as the Alton-Sodus Point road.

Top

Upper Clinton

Rochester Shale

9 ft. 3 in.	Brownish gray calcareous shale. A few limestone layers. Fossils not abundant and rock badly weathered.	*Mesotrypa nummiformis* *Dalmanella elegantula* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Atrypa reticularis* *Spirifer niagarensis* *Whitfieldella naviformis* *W. nitida oblata* *Pterinea emacerata* *Bumastus ioxus* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Beyrichia veronica*

Second creek flows over till for about one mile, below which the section continues and extends north of the old mill on the east-west road leading through the Alasa farms (former Shaker tract).

Upper Clinton

Rochester Shale

15 ft. 6 in.	Brownish gray shale. A few layers are calcareous. Near the base are a few argillaceous limestones. First ostracods appear 10 ft. 4 in. above base. Contact sharp and located 2525 ft. south of first east-west road to cross Second creek north of Alton.	*Enterolasma caliculum* *Zaphrentis turbinata* *Favosites pyriformis* *Dimerocrinus liliiformis* *Lyriocrinus dactylus* *Eucalyptocrinus caelatus* *Lecanocrinus macropetalus* *Stephanocrinus angulatus* *S. gemmiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Rhinopora verrucosa* *Pholidops squamiformis* *Orthis flabellites* *Dalmanella elegantula* *Sowerbyella transversalis* *Rhipidomella hybrida* *Schuchertella interstriata* *S. subplana* *S. tenuis* *Stropheodonta profunda* *Leptaena rhomboidalis* *Camarotoechia neglecta* *C. obtusiplicata* *Atrypa reticularis* *Atrypina disparilis* *Spirifer niagarensis* *S. radiatus* *S. sulcatus* *Leiopteria subplana* *Pterinea emacerata* *P. undata* *Platyceras angulatum* *P. niagarense* *Dawsonoceras annulatum* *Homalonotus delphinocephalus* *Cheirurus niagarensis* *Dalmanites limulurus* *Paraechmina spinosa* *Beyrichia veronica* *Dizygopleura proutyi*

Irondequoit Limestone

7 ft. 10 in.	Light gray, crystalline pyritic limestone. The upper part is more massive than the lower part. Many limestones crinoidal. Toward base limestone somewhat argillaceous. Reeflike bodies very common toward base. Reefs very fossiliferous. Limestone layers separated by thin shale layers. Shales thicker and more abundant toward base. Fauna of shales rich and varied.	*Enterolasma caliculum* *Dimerocrinus liliiformis* *Ichthyocrinus laevis* *Stephanocrinus gemmiformis* *Spatiopora maculata* *Chilotrypa ostiolata* *Eridotrypa striata* *Chasmatopora asperatostriata* *Pseudohornera diffusa* *Semicoscinium tenuiceps* *Rhinopora verrucosa* *Schizotreta tenuilamellata* *Dalmanella elegantula* *Orthis flabellites* *O. tenuidens* *Bilobites biloba*

	Most of fossils listed are from shales. Formation grades downward into underlying lowest layer about 2100 ft. south of road (east-west road leading from Alton-Sodus Point road through Alasa Farms).	*Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta convexa* *S. subplana* *Scenidium pyramidalis* *Dictyonella corallifera* *Camarotoechia obtusiplicata* *Atrypa gibbosa* *A. nodostriata* *A. reticularis* *A. rugosa* *Atrypina disparilis* *Cyrtia meta* *Reticularia bicostata* *Spirifer eudora* *S. niagarensis* *S. repertus* *S. sulcatus* *Trematospira camura* *Nucleospira pisiformis* *Whitfieldella cylindrica* *W. intermedia* *W. naviformis* *W. nitida* *Pterinea emacerata* *Conularia niagarensis* *Dawsonoceras annulatum* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis*
19 ft. 4 in.	Dark gray, crumbly, pyritic, calcareous shale. Argillaceous limestone layers in upper part. When weathered yellowish in color due to pyrite. Grades downward into underlying shale. Contact about 1300 ft. south of road.	*Semicoscinium tenuiceps* *Orthis tenuidens* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Chonetes cornutus* *Scenidium pyramidalis* *Clorinda fornicata* *Atrypa reticularis* *A. rugosa* *Cyrtia exporrecta myrtia* *Cyrtia meta* *Orthoceras abruptum* *Encrinurus ornatus* *Calymene clintoni* *Dalmanites limulurus* *Phacops trisulcatus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Beyrichia aff. lakemontensis* ***Dibolbina* n. sp.**

Williamson Shale

18 ft. 3 in.	Dark greenish gray, fissile, pyritic shale. Near base much darker in color with graptolites as	*Retiolites geinitzianus venosus* *Monograptus clintonensis* *Dalmanella elegantula* *Orthis flabellites*

	the only fossils. In the lowest part pyrite very abundant forming layers sometimes a half-inch thick. Contact sharp and located 365 ft. south of bridge on east-west road leading from Sodus Point - Alton road through the Alasa Farms.	*O. tenuidens* *Stropheodonta corrugata* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Scenidium pyramidalis* *Atrypa reticularis* *Atrypina disparilis* *Cyrtia meta* *Spirifer radiatus* *Hormotoma subulata* *Conularia niagarensis* *Calymene clintoni* *Dalmanites limulurus* *Beyrichia aff. lakemontensis* *Dibolbina* n. sp. *Mastigobolbina punctata* *M. typus*
4 in.	Two in. of coarse to fine, dark gray, phosphatic sandstone underlain by 2 in. of conglomerate. The individual pebbles are about a centimeter in diameter. They are loosely cemented. Some of the pebbles are limestone and closely resemble the underlying limestone. Other pebbles consist of quartz and their origin is difficult to explain. The sandstone and conglomerate indicate the break between Upper and Lower Clinton.	

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. 6 in.	Dark bluish gray calcareous shale with hematite. The basal 6 in. is composed largely of oolitic hematite. The upper part is dominantly a shale with oolites of hematite scattered through it. In this part oolites are commonly concentrated in bedding planes. The upper 6 in. is a solid mass of bryozoa. Grades into the underlying formation. Lowest layer 315 ft. south of road.	*Fenestella tenuis* *Semicoscinium tenuiceps* *Phaenopora constellata*

Wolcott Limestone

14 ft. 9 in.	Light bluish gray, crystalline limestone with interbedded bluish gray shales. Shale layers	*Favosites favosideus* *Chaetetes lycoperdon* *Chasmatopora angulata* *Fenestella tenuis*

	abundant in upper 5 ft. and lower 3 ft. Grades downward into underlying shale. Lowest layers just north of bridge.	*Semicoscinium tenuiceps* *Platystrophia biforata* *Leptaena rhomboidalis* *Pentamerus oblongus* *Atrypa reticularis* *Coelospira hemispherica* *Zygobolba decora* *Mastigobolbina decora*

Upper Sodus Shale

17 ft. 5 in.	Green to greenish gray shale with thin layers of limestone. Limestone usually pearly layers, but other brachiopods and even gastropods form some limestone. In upper part some layers bluish gray in color. Shale well-exposed. Very fossiliferous. Coelospirae appear dwarf in uppermost layers. The lowest layers outcrop in cliff 990 ft. north of bridge.	*Rusophycus pudicum* *Chaetetes lycoperdon* *Helopora fragilis* *Nematopora raripora* *Phaenopora constellata* *P. ensiformis* *Stropheodonta corrugata* *Camarotoechia aequiradiata* *Coelospira hemispherica* *Ctenodonta lata* *Pterinea emacerata* *Holopea obsoleta* *Strophostylus ventricosus* *Tentaculites minutus* *Phacops trisulcata* *Zygobolba decora* *Z. inflata* *Z. intermedia* *Z. robusta* *Mastigobolbina incipiens* *M. retifera*

SODUS CREEK SECTION 15

Town of Rose. County of Wayne. Small hamlet locally known as Glenmark. Rock outcrops on both sides of the bridge over Sodus creek on the road leading west from hamlet of North Rose.

Top

Lockport

15 ft.	Dark brownish gray, thin-bedded dolomite. Near the base the layers are sandy.	No fossils collected

Upper Clinton Contact gradational

Rochester Shale

2 ft. 6 in.	Transition bed. Crystalline limestone bearing fossils common in underlying shale interbedded with both thin-bedded sandy dolomitic layers of the overlying dolomite and brownish gray shale like the underlying formation. Several 2 in. and 3 in. layers composed of Nucleospira pisiformis. Fossils are all	*Enterolasma caliculum* *Zaphrentis turbinata* *Cystiphyllum niagarense* *Favosites hisingeri* *F. pyriformis* *Ceramopora imbricata* *Polypora incepta* *Pholidops squamiformis* *Dalmanella elegantula* *Orthis punctostriata* *Rhipidomella hybrida* *Schuchertella elegans* *S. tenuis*

	confined to the crystalline layers or to thin beds of brownish gray shale resembling the underlying Clinton. The dolomitic layers bear no fossils. This zone located 1475 ft. south of bridge.	*Leptaena rhomboidalis* *Atrypa reticularis* *Reticularia bicostata* *Spirifer niagarensis* *Homoeospira apriniformis* *Nucleospira pisiformis* *Whitfieldella nitida* *Diaphorostoma niagarense* *Conularia longa* *Proetus stokesi* *Arctinurus nereus* *Calymene niagarensis* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*
25 ft. 2 in.	Bluish gray, slightly dolomitic, calcareous shale with numerous tough, argillaceous limestone layers and a few medium gray, crystalline, thin, fossiliferous layers.	*Enterolasma caliculum* *Zaphrentis turbinata* *Cystiphyllum niagarense* *Favosites pyriformis* *Ceramopora imbricata* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Acanthoclema asperum* *Dalmanella elegantula* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella elegans* *S. subplana* *S. tenuis* *Stropheodonta profunda* *Camarotoechia neglecta* *Atrypa nodostriata* *A. reticularis* *A. rugosa* *Spirifer crispatus* *S. niagarensis* *S. radiatus* *S. sulcatus* *Trematospira camura* *Whitfieldella naviformis* *W. nitida* *Diaphorostoma hemisphericum* *Platyceras niagarense* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*
10 ft. 5 in.	Dark gray, calcareous, tough shales and argillaceous limestones. Fossils not so abundant as in overlying strata. Fifteen in. argillaceous limestone at top caps falls.	*Enterolasma caliculum* *Mesotrypa nummiformis* *Dalmanella elegantula* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Schuchertella subplana* *S. tenuis* *Camarotoechia neglecta* *Atrypa reticularis* *Spirifer niagarensis*

		S. radiatus *Platyceras niagarense* *Dalmanites limulurus* *Paraechmina spinosa*
4 ft.	Dark brownish gray, calcareous, tough shale with dark gray, argillaceous limestone layers. No fossils found. Lowest layer about 250 ft. north of bridge.	

BEAVER CREEK — SECTION 16

Town of Huron. County of Wayne. West branch of Beaver creek north of United States Highway 104. There are several isolated outcrops on this branch but only one seems of sufficient note to warrant description.

Top

Upper Clinton

Rochester Shale

18 ft. 10 in.	Dark bluish gray shale somewhat calcareous. Some layers have a brownish color. Ostracods were found to within 4 ft. 6 in. of the base. Contact sharp and 3150 ft. south of United States Highway 104.	*Enterolasma caliculum* *Fenestella elegans* *Chaetetes lycoperdon* *Dimerocrinus liliiformis* *Lecanocrinus macropetalus* *Acanthoclema asperum* *Dalmanella elegantula* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Camarotoechia neglecta* *C. obtusiplicata* *Atrypa reticularis* *Homoeospira apriniformis* *Nucleospira pisiformis* *Whitfieldella cylindrica* *W. nitida* *Pterinea emacerata* *Dawsonoceras annulatum* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa*

Irondequoit Limestone

6 ft. 8 in.	Light gray, crystalline limestone with prominent shale partings. Thickness of shales increase downward. Reeflike bodies common. Limestone layers fossiliferous. Shale and reefs very fossiliferous with much greater variety of	*Enterolasma caliculum* *Favosites pyriformis* *Lecanocrinus macropetalus* *Stephanocrinus gemmiformis* *Chilotrypa ostiolata* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Semicoscinium tenuiceps* *Rhinopora verrucosa* *Stictotrypa punctipora*

	fossils. Grades downward into underlying shale.	*Dalmanella elegantula* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta deflecta* *S. profunda* *Clorinda fornicata* *Camarotoechia neglecta* *Atrypa nodostriata* *A. reticularis* *Atrypina disparilis* *Reticularia bicostata* *Spirifer eudora* *S. niagarensis* *S. radiatus* *Whitfieldella cylindrica* *W. intermedia* *W. nitida* *Pterinea emacerata* *Conularia niagarensis* *Dawsonoceras annulatum* *Dalmanites limulurus* *Mastigobolbina punctata* *M. typus* *Dibolbina* n. sp.
7 ft.	Bluish gray, calcareous shale with a few limestone layers. Badly weathered and hard to obtain good fossils because of this. Probably contains more fossils than listed.	*Dalmanella elegantula* *Bilobites biloba* *Leptaena rhomboidalis* *Chlorinda fornicata* *Atrypa reticularis* *Spirifer radiatus* *Whitfieldella cylindrica* *W. nitida* *Mastigobolbina punctata* *M. trilobata*

Mudge Creek **Section 17**

Town of Huron. County of Wayne. Outcrops both above and below the first bridge across Mudge creek south of North Huron. There are other outcrops on Mudge creek, but they are isolated and too small to be of importance.

Top

Lower Clinton

Wolcott Limestone

8 ft. 9 in.	Light gray limestone. Some layers crystalline. Thin light bluish gray calcareous shale common. Pentamerus mostly in crystalline limestone. Some shales bear bryozoans, others Coelospira. Ostracods most abundant in shales with Coelospira. Coelospira appear	*Chaetetes lycoperdon* *Chasmatopora angulata* *Fenestella tenuis* *Semicoscinium tenuiceps* *Helopora fragilis* *Nematopora raripora* *Phaenopora ensiformis* *Pachydictya crassa* *Rhipidomella circulus* *Stropheodonta corrugata* *Pentamerus oblongus*

	dwarfed in some layers. Contact gradational and 400 ft. downstream from bridge.	*Camarotoechia neglecta* *Atrypa reticularis* *Spirifer radiatus* *Cornulites distans* *Calymene niagarensis* *Mastigobolbina incipiens* *M. retifera* *Zygobolba decora*

Upper Sodus Shale

8 ft. 9 in.	Greenish gray and bluish gray calcareous shales with limestone layers composed of Coelospira. Coelospira dwarf in shale layers at top. The whole section is exposed 850 ft. below the bridge in a small cliff.	*Helopora fragilis* *Nematopora raripora* *Phaenopora ensiformis* *Dalmanella elegantula* *Rhipidomella circulus* *Stropheodonta corrugata* *Rhynchotreta robusta* *Atrypa reticularis* *Coelospira hemispherica* *Pterinea emacerata* *Strophostylus ventricosus* *Cornulites distans* *C. flexuosus* *Calymene niagarensis* *Zygobolba decora* *Z. inflata* *Z. intermedia* *Z. robusta* *Mastigobolbina incipiens* *M. retifera*

Wolcott Creek — Section 18

Town of Wolcott. County of Wayne. Within the village rock outcrops in gorge north of mill pond. This is an excellent section of the middle portion of the Rochester. Wolcott creek exposes the lower formations but the outcrops are so small and badly weathered that they are not included.

Top

Upper Clinton

Rochester Shale

34 ft.	Brownish gray, calcareous shale with abundant dark brownish gray, argillaceous limestone layers. Limestones dominate in upper part. One layer particularly resistant 5 ft. 3 in. thick forms cap of Wolcott falls. Fossils comparatively rare. Many layers barren. Grades into underlying shale.	*Enterolasma caliculum* *Dalmanella elegantula* *Sowerbyella transversalis* *Leptaena rhomboidalis* *Stropheodonta profunda* *Atrypa reticularis* *Spirifer radiatus* *Platyceras niagarensis* *Homalonotus delphinocephalus* *Dalmanites limulurus*

22 ft. 9 in.	Brownish gray, calcareous shale with very few argillaceous limestones. Fossils abundant. Some layers filled with them. Whitfieldella cylindrica very common in lowest layers exposed in stream bed. Fossils of this species making up the major part of some layers. Lowest layer outcrops in stream bed 525 ft. downstream from falls.	*Favosites hisingeri* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Pholidops squamiformis* *Dalmanella elegantula* *Rhipidomella hybrida* *Sowerbyella transversalis* *Schuchertella subplana* *Stropheodonta profunda* *Leptaena rhomboidalis* *Camarotoechia neglecta* *C. obtusiplicata* *Atrypa nodostriala* *A. reticularis* *Spirifer radiatus* *S. sulcatus* *Whitfieldella cylindrica* *W. nitida* *W. nitida oblata* *Pterinea emacerata* *Platyceras niagarense* *Proetus corycoeus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*

LITTLE WOLCOTT CREEK — SECTION 19

Town of Wolcott. County of Wayne. The creek is unnamed on the topographic map. It flows east of and parallel with Wolcott creek. The first outcrop on this creek is near the railroad bridge (Rome, Watertown and Ogdensburg Division of the New York Central). The Rochester part of the section is so poorly exposed that it will not be described. North of the second cross road north of the village of Wolcott the outcrops are more continuous and not so badly weathered.

Top

Upper Clinton

Irondequoit Limestone

5 ft. 6 in.	Bluish gray limestone. Some layers crystalline but mostly argillaceous with a dull gray color. The upper layer has reeflike bodies. The shale partings have the greatest fauna. The highest layer outcrops 1200 ft. downstream from the cross road. Lower limit very arbitrary.	*Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Semicoscinium tenuiceps* *Dalmanella elegantula* *Orthis flabellites* *O. tenuidens* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Chlorinda fornicata* *Atrypa nodostriata*

		A. reticularis *A. rugosa* *Atrypina disparilis* *Spirifer eudora* *S. niagarensis* *S. radiatus* *S. sulcatus* *Cyrtina pyramidalis* *Trematospira camura* *Nucleospira pisiformis* *Whitfieldella cylindrica* *W. intermedia* *Cuneamya alveata* *Leptodesma rhomboidea* *Leiopteria subplana* *Pterinea emacerata* *Platyceras niagarense* *Cornulites distans* *Orthoceras abruptum* *Dawsonoceras annulatum* *Proetus corycocus* *P. stokesi* *Calymene clintoni* *C. niagarensis* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *Plethobolbina typicalis* *Dizygopleura intermedia cornuta*
10 ft. 5 in.	Upper part bluish gray, argillaceous limestone dominates. Lower part bluish gray, crumbly, calcareous shale dominates. Ostracods common. Other fossils rare. Highest layer 1450 ft. north of bridge.	*Dalmanella elegantula* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Chonetes cornutus* *Chlorinda fornicata* *Atrypa gibbosa* *A. reticularis* *Dawsonoceras annulatum* *Calymene clintoni* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Beyrichia aff. lakemontensis*
22 ft.	Dark bluish gray, calcareous, crumbly shale. Weathers a yellow limonitic color. Pyrite abundant in fresh rock. Highest layer 2550 ft. north of bridge. Lowest 1500 ft. south of point where Port Bay road crosses creek.	*Bilobites biloba* *Leptaena rhomboidalis* *Schuchertella subplana* *Chonetes cornutus* *Chlorinda fornicata* *Atrypa reticularis* *Spirifer radiatus* *Dawsonoceras annulatum* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Beyrichia aff. lakemontensis* *Dibolbina* n. sp.

5 ft.	**Green** fissile shale. Shale exposed on downthrown side of a fault. The fault is 920 ft. south of Port Bay road. The fault may be seen in a small cliff on the west side of the valley. The fault shows **about 15 ft.** of displace**ment.**	*Chaetetes lycoperdon* *Retiolites geinitzianus venosus* *Monograptus clintonensis* *Rhipidomella hybrida* *Sowerbyella transversalis* *Stropheodonta corrugata* *Chonetes cornutus* *Scenidium pyramidale* *Atrypa nodostriata* ***A. reticularis*** ***Spirifer eudora*** ***S. radiatus*** ***Coelospira sulcata*** ***Calymene clintoni*** *Mastigobolbina punctata* *M. trilobata* *M. typus* *Beyrichia aff. lakemontensis* ***Dibolbina* n. sp.**

Lower **Clinton**

Wolcott Limestone

10 ft. 6 in.	Light bluish gray, crystalline limestone. Shale layers common. This limestone on upthrown side of fault. Shale becomes more abundant toward base. Grades to underlying shale. The lowest layer of limestone is 310 ft. south of road.	*Zaphrentis bilateralis* *Fenestella tenuis* *Semicoscinium tenuiceps* *Helopora fragilis* *Phaenopora ensiformis* *Platystrophia biforata* *Rhipidomella circulus* *Stropheodonta corrugata* *Chonetes cornutus* *Pentamerus oblongus* *Camarotoechia neglecta* *Coelospira hemispherica* *Mastigobolbina incipiens* *M. retifera* *Zygobolba decora*

Upper Sodus Shale

2 ft.	Greenish gray and light bluish gray shale with a limestone lens of Coelospira. Coelospirae appear dwarfed. Poor outcrop. All rock exposed in stream bed.	*Phaenopora constellata* *P. ensiformis* *P. explanata* *Helopora fragilis* *Stropheodonta corrugata* *Coelospira hemispherica* *Strophostylus ventricosus* *Holopea obsoleta* *Cornulites distans* *Zygobolba decora* *Z. inflata* *Z. intermedia* *Z. robusta* *Mastigobolbina* ***incipiens*** *M. retifera*

NORTH WOLCOTT SECTION 20

Town of Wolcott. County of Wayne. Little Red creek flows into Red creek. The first outcrop occurs 1525 feet north of the four **corners at North Wolcott.**

Top

Lower Clinton

Thorold Sandstone

4 ft. 3 in.	Light gray sandstone with small pellets of embedded shale. Some layers calcareous. Deeply weathered. Weathering causes formation to first break into rectangular pieces, then crumble into white sandy soil. Contact sharp and located 1675 ft. north of four corners.	*Arthrophycus alleghaniensis*

Albion Group

Grimsby Sandstone

15 ft.	Red sandstone. Tightly cemented, very resistant red sandstone. Many conglomeratic layers in upper part.	*Arthrophycus alleghaniensis*

BEAR CREEK SECTION 21

Town of Wolcott. County of Wayne. Rock is exposed on a small tributary of Black creek which is locally known as Bear creek. This tributary enters Black creek a short distance to the north of where the southwest road from Fair Haven crosses Black creek. That part of the section which is below the ore is poorly exposed and was uncovered by digging. The part of the section above the ore is well exposed, not only in the stream bed of Bear creek but also in the old ore pits just to the north of the stream. The ore pits are known as the Devoe ore pits. This is the type section of the Bear creek.

Top

Lower Clinton

Lower Sodus Shale

10 ft 5 in.	Dark gray or purple shale. Some green shale. A few sandy layers. Very fossiliferous. Contact sharp.	*Buthotrephis gracilis* *Chaetetes lycoperdon* *Phaenopora ensiformis* *Helopora fragilis* *Stropheodonta corrugata* *Coclospira hemispherica* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. prolixa* *Z. rectangula*

Bear Creek Shale

3 in.	Oolitic hematitic limestone. Grades downward into underlying limestone.	*No fossils collected*
8 in.	Dark gray, argillaceous, slightly sandy limestone. Upper part hematitic. Few fossils.	*Coelospira hemispherica*
5 ft.	Dark gray or purple, pyritic shale with thin argillaceous, pyritic limestones near top and middle. Pelecypods very abundant.	*Chaetetes lycoperdon* Crinoid stems *Helopora fragilis* *Phaenopora ensiformis* *P. clintoni* *Lingula oblata* *L. perovata* *Stropheodonta corrugata* *Rhynchonella emacerata* *Coelospira hemispherica* *Ctenodonta lata* *C. machaeriformis* *C. mactriformis* *Pyrenomoeus cuneatus* *Cyrtodonta alata* *Pterinea emacerata* *Modiolopsis subalatus* *Orthodesma curtum* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. prolixa* *Z. rectangula*
7 in.	Dark gray, argillaceous limestone layer.	Crinoid stems *Coelospira hemispherica*
6 ft. 10 in.	Dark gray or purple pyritic shales with alternating dark gray, argillaceous, pyritic limestones. Contact sharp.	*Coelospira hemispherica* *Ctenodonta machaeriformis* *Pterinea emacerata* *Zygobolba curta* *Z. excavata* *Z. prolixa* *Z. rectangula*

Furnaceville Iron Ore

20 in.	Oolitic, fossiliferous, hematitic limestone. Contact gradational.	*Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Coelospira hemispherica* *Zygobolba curta* *Z. excavata* *Z. rectangula*

Thorold Sandstone

8 in.	Alternating shale and limestone and sandy shale. Fossils rare and poorly preserved.	*Stropheodonta corrugata* *Coelospira hemispherica*
2 ft.	Covered	
2 ft.	Gray sandstone. Poorly preserved.	

BLIND SODUS CREEK SECTION 22

Town of Sterling. County of Cayuga. Outcrop located on main branch of Blind Sodus creek one and one-half miles east of the village of Red Creek on the improved Red Creek-Sterling Station road. It is the third stream shown crossing the road east of Red Creek. Rock is exposed both to north and south of road. Main outcrops are to the north.

Top

Upper Clinton

Rochester Shale

12 ft. 9 in.	Brownish gray, calcareous shale very poorly exposed except basal 5 ft. Lowest layer outcrops 115 ft. north of road. **Contact sharp.**	*Enterolasma caliculum* *Mesotrypa nummiformis* *Chasmatopora asperostriata* *Fenestella elegans* *Rhinopora verrucosa* *Dalmanella elegantula* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Leptaena rhomboidalis* *Spirifer niagarensis* *S. radiatus* *Whitfieldella naviformis* *W. nitida* *Pterinea emacerata* *P. undata* *Cypricardinia undulostriata* *Orthoceras abruptum* *Proetus stokesi* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina spinosa* *Dizygopleura proutyi*

Irondequoit Limestone

18 ft. 9 in.	Gray, calcareous shale with many limestone layers. Most limestone argillaceous with some fossils A few crystalline crinoidal layers in upper 5 ft. Reeflike bodies in upper 5 ft. Most shale crumbly and weathers rust colored. Some thin bedded. Graptolites at two horizons, one 4½ ft. from top, the other near base. Ostracods very abundant in layer 6 in. below top. Contact gradational and 800 ft. downstream from bridge.	*Enterolasma caliculum* *Dictyonema subretiforme* *Mesotrypa nummiformis* *Fenestella elegans* *Rhinopora verrucosa* *Dalmanella elegantula* *Rhipidomella hybrida* *Sowerbyella transversalis* *Leptaena rhomboidalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Camarotoechia neglecta* *Atrypa gibbosa* *A. reticularis* *Atrypina disparilis* *Spirifer niagarensis* *S. radiatus* *Whitfieldella cylindrica*

		W. intermedia *Pterinea emacerata* *Amphicoelia orbiculoides* *Dawsonoceras annulatum* *Mastigobolbina typus* *Plethobolbina typicalis*
13 ft. 6 in.	Bluish gray shale, some calcareous, some fissile. No limestone layers. Graptolites found throughout but not abundantly. Fossils comparatively rare. Lowest layer about 1200 ft. downstream from road.	*Monograptus clintonensis* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Atrypa reticularis* *Spirifer niagarensis* *S. radiatus* *Whitfieldella cylindrica* *W. intermedia* *W. naviformis* *W. nitida* *Dawsonoceras annulatum* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis*

STERLING STATION — SECTION 23

Town of Sterling. County of Cayuga. In the past iron ore has been mined at Sterling Station. In the mining of this ore a considerable amount of rock has been uncovered. There are three major openings all located to the west of Sterling Station, near the first four corners in that direction. One is situated just northwest of these corners, another to the southeast of the corners, and still another, the most recent, is east of the railroad (New York Central: Rome, Watertown and Ogdensburg Division). Only two of these openings will be described in detail.

Opening northwest of the first four corners. Oldest pit in the area. Because the pits are filled with water and the sides overgrown, no good opportunity is given to study the section above the ore. On the small streams to the west of the openings the rock underlying the ore is exposed.

Top

Lower Clinton

Thorold Sandstone

5 ft. 8 in.	Light gray slightly calcareous sandstone with embedded green shale pellets. The upper part very shaly and light greenish gray in color. Evidently rock directly underlies ore. Contact gradational.	*Arthrophycus alleghaniensis*

Albion Group

Grimsby Sandstone

3 ft.+	Red sandstone with light green blotches. Some conglomeratic layers.	*Arthrophycus alleghaniensis*

Opening east of railroad. The rock above the ore is well exposed east of railroad in the most recent workings.

Lower Clinton

Lower Sodus Shale

7 ft. 6 in.	Dark greenish gray shale with thin limestone layers. Some thin sandy layers noted. Fossils often preserved as limonitic casts. Contact sharp.	*Helopora fragilis* *Phaenopora ensiformis* *Lingula perovata* *Stropheodonta corrugata* *Coelospira hemispherica* *Pterinea emacerata* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa*

Bear Creek Shale

3 in.	Hematitic, oolitic limestone. No fossils. Contact gradational.	
7 in.	Gray, sandy limestone. Upper part hematitic. Fossils rare. Two *Pentamerus oblongus* found. Fossil burrows or trails found in basal part. Closely resemble Arthrophycus. Contact sharp.	*Arthrophycus alleghaniensis* *Lingula perovata* *Coelospira hemispherica* *Pentamerus oblongus* *Tentaculites minutus*
1 ft. 6 in.	Dark gray or purple shale. Thin crystalline limestone. Coelospira.	*Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Stropheodonta corrugata* *Coelospira hemispherica* *Encrinurus ornatus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa*
4 ft. 6 in.	Dark gray or purple shale with few limestone layers. Lower part poorly exposed. Pelecypods very abundant.	*Helopora fragilis* *Phaenopora ensiformis* *Lingula clintoni* *L. oblata* *L. perovata* *Stropheodonta corrugata* *Coelospira hemispherica* *Ctenodonta elliptica* *C. machaeriformis* *C. mactriformis* *Pyrenomoeus cuneatus* *Pterinea emacerata*

		Modiolopsis subalata *Tentaculites minutus* *Zygobolba curta* *Z. elongata ?* *Z. excavata* *Z. inflata* *Z. prolixa*
5 ft.	Covered with water. Thickness from records of engineers.	

Furnaceville Iron Ore

2 ft. 6 in.	Red hematitic, oolitic limestone. Fossils rare. Covered with water. Thickness from records of engineers. Fossils from ore dump.	*Zaphrentis bilateralis* *Helopora fragilis* *Phaenopora ensiformis* *Coelospira hemispherica* *Tentaculites minutus* *Zygobolba curta*

LITTLE SODUS CREEK SECTION 24

Town of Victory. County of Cayuga. Rock outcrops where stream crosses the road leading south from North Victory near the southern boundary of the Oswego quadrangle. Rock is exposed 200 feet upstream from bridge and 1350 feet downstream.

Top

Upper Clinton

Rochester Shale

22 ft. 6 in.	Dark brownish gray shale. Some layers calcareous. Few thin sandstone layers. 3 in. hematitic layer near middle. Fossiliferous. Whole section exposed but not continuously.	*Favosites hisingeri* *Dictyonema gracilis* *Ceramopora imbricata* *Mesotrypa nummiformis* *Chasmatopora asperatostriata* *Fenestella elegans* *Semicoscinium tenuiceps* *Rhinopora verrucosa* *Dalmanella elegantula* *Orthis flabellites* *Rhipidomella hybrida* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *S. tenuis* *Stropheodonta profunda* *Camarotoechia neglecta* *C. obtusplicata* *Atrypa reticularis* *Spirifer niagarensis* *S. radiatus* *Whitfieldella nitida* *Pterinea emacerata* *Cypricardinia undulostriata* *Diaphorostoma hemisphericum* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi*

MARTVILLE (LUNN'S QUARRY) SECTION 25

Town of Hannibal. County of Oswego. Lower part of section exposed in an old quarry locally known as Lunn's which is situated 500 feet south of first four corners southwest of Hannibal on United States Highway 104. The rest of the section outcrops on a small tributary of Sterling Valley creek which flows west through the quarry to enter the main stream.

Top

Lower Clinton

Lower Sodus Shale

19 ft. 10 in.	Green and dark purplish gray shale interbedded. In the basal part the purplish shale predominates. In the upper part the green predominates. Some thin limestone layers. Pelecypods abundant in lower part. They are restricted for the most part to definite layers. Not many other fossils associated with them. Contact sharp.	*Chaetetes lycoperdon* *Dictyonema gracilis* *Dendocrinus longidactylus* *Helopora fragilis* *Phaenopora ensiformis* *Stropheodonta corrugata* *Coelospira hemispherica* *Ctenodonta machaeriformis* *Pyrenomoeus cuneatus* *Pterinea emacerata* *Modiolopsis subalata* *Holopea obsoleta* *Tentaculites minutus* *Cornulites distans* *Encrinurus ornatus* *Phacops triculcatus* *Zygobolba curta* *Z. excavata* *Z. inflata* *Z. prolixa* *Z. rectangula*

Bear Creek Shale

3 in.	Red oolitic, hematitic limestone. Grades downward into underlying. No fossils observed.	
11 ft. 3 in.	Dark gray or purple shale. Calcareous layers common. Few argillaceous dark gray limestones. Stringers of hematite in upper 18 in. and in lower 30 in. Thin sandy layers common throughout. Pelecypods abundant. Ostracods very common and often replaced by limonite. Contact not well-defined.	*Helopora fragilis* *Phaenopora ensiformis* *Lingula clintoni* *L. oblata* *L. perovata* *Pholidops squamiformis* *Stropheodonta corrugata* *Coelospira hemispherica* *Ctenodonta machaeriformis* *C. mactriformis* *Pyrenomoeus cuneatus* *Modiolopsis subalatus* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. prolixa*

Furnaceville Iron Ore

1 ft. 6 in.	Argillaceous, hematitic limestone with many shale layers. Upper 4 in. contains considerable hematite. Very pyritic near middle. Fossils rare and poorly preserved. Contact not sharp.	*Helopora fragilis* *Phaenopora ensiformis* *Stropheodonta corrugata* *Coelospira hemispherica* *Tentaculites minutus* *Zygobolba curta* *Z. excavata* *Z. prolixa*

Thorold Sandstone

7 ft. 5 in.	Gray calcareous sandstone with interbedded green shale layers. Phosphatic nodules common especially in central part. Conglomeratic layer about 3 ft. 6 in. from top. Lower 2 ft. 6 in. gray sandstone with embedded clay pellets. Arthrophycus in basal part. Lingula in upper. Ostracods in green shale breaks. Very poorly preserved.	*Arthrophycus alleghaniensis* *Lingula clintoni* *L. oblata* *L. perovata* *Zygobolba curta?* *Z. prolixa?*

Albion Group

Grimsby Sandstone

4 ft.	Red sandstone. Some layers contain green blotches.	*Arthrophycus alleghaniensis*

STERLING VALLEY CREEK SECTION 26

Town of Hannibal. County of Oswego. Rock is found in stream bed north of first four corners east of Martville on the Martville-Hannibal Center road. The exposure is immediately west of mill pond (no longer in existence) shown on topographic map.

Top

Lower Clinton

Upper Sodus Shale

10 ft. 6 in.	Green shale with limestone layers. Limestone crystalline. Some entirely composed of Coelospira. The highest layers outcrop at the mill-pond, the lowest 735 ft. to the west.	*Helopora fragilis* *Phaenopora ensiformis* *P. explanata* *Leptaena rhomboidalis* *Stropheodonta corrugata* *Atrypa reticularis* *Coelospira hemispherica* *Pterinea emacerata* *Pyrenomoeus cuneatus* *Tentaculites minutus* *Calymene niagarensis* *Zygobolba decora* *Z. intermedia* *Z. robusta* *Mastigobolbina incipiens* *M. retifera*

OSWEGO RIVER SECTION 27

Towns of Volney and Granby. County of Oswego. Outcrop is located within the limits of the city of Fulton, just south of Broadway bridge.

Top

Lower Clinton

Oneida Conglomerate

12 ft. 9 in.	White sandstone with conglomeratic layers. Some green shale layers. Some layers slightly calcareous near center of formation. This portion finer-grained with embedded shale pellets.	*Arthrophycus alleghaniensis*

Albion Group

Grimsby Sandstone

8 ft.	Red sandstone. Cross-bedded. Many layers very argillaceous, Some even sandy shales.	*Arthrophycus alleghaniensis*

PHOENIX SECTION 28

Town of Schroeppel. County of Oswego. Within the village of Phoenix rock forms the bed of the Oswego branch of the Barge canal. When the original excavation was made for the canal, the rock taken from the canal was piled up on the east bank in the extreme northwestern part of the village limits. During the summer of 1935 the canal bed was lowered near the locks at Phoenix. Fossil collections were made from the dump and from the dredge. The engineers working on the dredge furnished data showing that the section excavated was about 20 feet thick. A comparison of the lithology of these rocks with that of the rock of the diamond drill core from South Granby about five miles west shows that these rocks are part of the uppermost Williamson. The dark bluish crumbly shale suggests that some of the lowest Irondequoit may be represented. The absence of *Plethobolbina typicalis* and the presence of *Dibolbina* n. sp. and *Beyrichia* aff. *lakemontensis* argues for a Williamson age of the whole section.

Top

Upper Clinton

Williamson Shale

20 ft.	Green fissile shale interbedded with dark bluish gray crumbly shale. Limestone layers are common. Some are com-	*Buthotrephis gracilis* *Enterolasma caliculum* *Dictyonema gracilis* *D. retiforme* *Retiolites geinitzianus venosus*

posed entirely of Sowerbyella, some largely of Atrypa, others contain a variety of fossils. Still others are crystalline with no fossils. Graptolites confined to green fissile shales. Ostracods most plentiful in dark bluish gray **calcareous** shale.	*Monograptus clintonensis* *Pholidops squamiformis* *Dalmanella elegantula* *Orthis tenuidens* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Stropheodonta corrugata* *Chonetes cornutus* *Scenidium pyramidale* *Rhynchonella bidens* *Atrypa nodostriata* *A. reticularis* *Atrypina disparilis* *Cyrtia meta* *Spirifer radiatus* *Coelospira sulcata* *Ctenodonta mactriformis* *Hormotoma subulata* *Orthoceras bassleri* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Beyrichia aff. lakemontensis* *Dibolbina* n. sp.

BREWERTON SECTION 29

Town of Cicero. County of Onondaga. Rock outcrops in the outlet to Oneida lake. This can be obtained only when the water is extremely low. Within the village limits the soft shale rock is found south of Oneida river, and all the road cuts expose layers of this shale. The shale in these road cuts is badly weathered. One of the best outcrops for collecting fossils is on United States Highway 11, 450 feet south of Oneida river. Another is located on the only road leading west from the village 425 feet west of the railroad. From the diamond drill core it appears that the lowest layers outcropping in the outlet of Oneida lake are within 10 feet of the base of the Williamson.

Top

Upper Clinton

Williamson Shale

45 ft.	Green fissile shale with minor limestone lenses. The shale abounds in pyrite. This pyrite weathers rapidly giving the whole outcrop a limonitic color. The layers which contain the greatest amount of pyrite are devoid of animal remains. In other layers the organisms appear to have been dwarfed by the	*Palaeocyclus rotuloides* *Enterolasma caliculum* *Dictyonema gracilis* *D. retiforme* *Retiolites geinitzianus venosus* *Monograptus clintonensis* *Lingula lamellata* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Chonetes cornutus* *Scenidium pyramidale*

pyritic conditions. The limestone layers are often unfossiliferous but a few are composed largely of fossils. Two such fossiliferous layers are made up of *Coelospira sulcata*. The thickness was determined by taking the elevation by means of a level of the lowest and highest layers outcropping.	*Camarotoechia acinus* *Atrypa reticularis* *Cyrtia meta* *Spirifer radiatus* *Coelospira sulcata* *Ctenodonta mactriformis* *Leptodesma rhomboideum* *Pterinea emacerata* *Cyclonema varicosum* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Beyrichia aff. lakemontensis* *Dibolbina* n. sp.

Oneida Lake Beach — Section 30

Town of Sullivan. County of Madison. The outcrop is located half-way between Lakeport and the summer resort which is named Oneida Lake, on the topographic map. This part of the lake shore is now known as Oneida Lake beach. At this point the rock forms the beach of Oneida lake. Although only a small section is exposed at this point, its place in the section can be determined with some degree of accuracy. There are old Lockport quarries less than three-quarters of a mile to the south. The Rochester-Lockport contact was uncovered in a large drainage ditch which follows the course of Canaseraga creek, and is located immediately south of the bridge over this creek. These outcrops together with the diamond drill core, one and one-half miles northeast of Lakeport, show that the Oneida Lake beach outcrop must be about 30 feet below the top of the Rochester.

Top

Upper Clinton

Rochester Shale

6 ft. 9 in.	Gray, sandy, dolomitic limestone. Some layers are shaly. Stringers of hematite common, particularly near center. Crinoid stems form some of the more pure layers.	*Enterolasma caliculum* *Favosites hisingeri* *Leptaena rhomboidalis* *Schuchertella subplana* *Camarotoechia neglecta* *Spirifer radiatus* *Nucleospira pisiformis* *Whitfieldella nitida oblata* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa*

Stony Creek — Section 31

Town of Verona. County of Oneida. There are a number of fragmentary outcrops on Stony creek and its tributaries. The one farthest south is located one and a half miles southwest of Verona

Station. The rock outcrops on both sides of a bridge over the stream. This bridge is on a road leading northwest from the main road between Verona and Oneida. It is the third road to lead westward, southwest of Verona. Old quarry located south of road.

Top

Upper Clinton

Herkimer Sandstone

50 ft.	Brownish gray sandstone with an abundance of bluish gray shale layers. Most sandstone layers are thin. Some have mud cracks, some bear the so-called plants. No continental sandstone discovered. Most of the fossils occur in the sandstones and are preserved as casts and molds.	*Paleophycus striatum* *Rusophycus biloba* *R. subangulatum* *Cladopora seriata* *Chilotrypa ostiolata* *Hallopora elegantula* *Clathropora frondosa* *Dalmanella elegantula* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Rafinesquina obscura* *Schuchertella subplana* *Stropheodonta profunda* *Camarotoechia neglecta* *Atrypa reticularis* *Spirifer niagarensis* *S. radiatus* *Cuneamya alveata* *Leptodesma rhomboidea* *Pterinea emacerata* *Calymene niagarensis* *Arctinurus nereus* *Homalonotus delphinocephalus* *Dalmanites limulurus*

No exposures for one mile downstream. At that point rock outcrops in one of the branches of Stony creek. Taking into account the dip of the rock, which was computed as 64 feet to the mile (computed on the Oneida conglomerate outcrop and comparing test hole elevation with outcrop elevation) there is about 67 feet covered.

Top

Middle Clinton

Sauquoit Shale

21 ft.	Green sandy, fissile shale with sandstone members. Sandstones fine-grained. Pyrite very common. Both shales and sandstones fossiliferous. Ostracods very abundant in sandstone. Some of outcrops deeply weathered.	*Rhipidomella circulus* *Chonetes cornutus* *Coelospira hemispherica* *Cyrtodonta alata* *Pterinea emacerata* *Bucanella trilobata* *Cyclonema varicosum* *Kionoceras cancellatum* *Calymene clintoni* *Dalmanites (limulurus)?* *Chilobolbina hartfordensis* *Zygobolbina conradi* *Mastigobolbina clarkei* *M. lata* *M. lata* var. *nana* *M. vanuxemi*

Downstream Stony creek and its tributary again flow over glacial material for a mile and one-tenth. The next outcrop occurs eight-tenths of a mile northeast of Verona Station on the west side of the main line of the New York Central railroad, where it makes a slight bend. This location was once worked for iron ore. The pits themselves are filled with water. In a dry time the water level apparently stands about one foot and a half above the ore. (The writer obtained a piece of ore, which was thought to be in place, with the aid of a bar.) Besides the outcrop right at the pits higher layers of shale may be studied east of the pits near the railroad. Weathered specimens of very fossiliferous ore may be obtained from the dumps near the pits.

Sauquoit Shale

10 ft.	Bluish gray, thin-bedded, sandy shales with very sandy, thin limestones. Fossiliferous. Casts of ostracods abundant in weathered sandy limestone.	*Rhipidomella circulus* *Chonetes cornutus* *Atrypa reticularis* *Coelospira hemispherica* *Liocalymene clintoni* *Zygobolbina conradi* *Mastigobolbina clarkei* *M. lata* *M. vanuxemi*

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. 5 in.	Red, fossiliferous, hematitic limestone. Thickness of this ore given by Newland and Hartnagel ('08, p. 67). Can not be accurately measured now.	*Zaphrentis bilateralis* *Fenestella tenuis* *Phaenopora constellata* *P. ensiformis* *P. explanata* *Dalmanella elegantula* *Leptaena rhomboidalis* *Rhynchotreta robusta* *Atrypa reticularis* *Coelospira hemispherica* *Encrinurus ornatus* *Zygobolba decora* *Z. oblonga* *Mastigobolbina incipiens* *M. retifera*

The rest of the Clinton above the Oneida conglomerate is very poorly exposed. Small isolated fragmentary outcrops of shale are found jutting out here and there from the southwest bank of a tributary to Stony creek flowing northwest about six-tenths of a mile northeast of Verona.

Upper Sodus Shale

Greenish shale with a few thin sandstone layers. One thin limestone was found in place. Some pieces of cherty limestone float observed.	*Zaphrentis bilateralis* *Favosites favosideus* *Chaetetes lycoperdon* *Chasmatopora angulata* *Fenestella tenuis* *Helopora fragilis*

Some shale very fossiliferous. Fossils more resistant than enclosing shale. Highest layer of outcropping shale about 10 ft. below ore pit located on the same stream.	*Phaenopora ensiformis* *Platystrophia biforata* *Leptaena rhomboidalis* *Stropheodonta corrugata* *Rhynchotreta robusta* *Atrypa reticularis* *Coelospira hemispherica* *Ctenodonta lata* *Pyrenomoeus cuneatus* *Pterinea emacerata* *Modiolopsis ovata* *Orthodesma curtum* *Orthoceras clavatum* *O. virgulatum* *Discosorus conoideus* *Actinoceras vertebratum* *Oncoceras subrectum* *Calymene senaria* *Calymenella rostrata* *Zygobolba decora* *Z. inflata* *Z. oblonga* *Z. robusta*

The Oneida conglomerate outcrops 300 feet north of the three corners, located one and a half miles due north of Verona. To the south of the massive conglomerate interbedded green shales and thin sandstones are found outcropping in the drainage ditch along the road. No attempt was made to measure the section. The following are lists of fossils found in the shales and sandstone.

From the shale layers.	*Zaphrentis bilateralis* *Helopora fragilis* *Phaenopora ensiformis* *Leptaena rhomboidalis* *Camarotoechia robusta* *Coelospira hemispherica* *Tentaculites minutus* *Zygobolba decora* *Z. inflata*
From the sandstone and conglomerate layers.	*Arthrophycus alleghaniensis*

College Hill Creek — Section 32

Town of Kirkland. County of Oneida. College Hill creek is the first stream shown on the topographic map which flows into Oriskany creek north of College Hill. The exposure is poor because so much of the course is covered by débris and because the stream is interrupted by dams.

Top

Vernon Shale

87 ft.	Vernon red shale. Some green shale near base. Outcrops at bridge over College Hill creek and continues downstream 955 ft.

Lockport Dolomite

63 ft.	Dark gray argillaceous dolomite. Some shale layers. Abundance of dark gray dolomitic shale at base especially. Contact unconformable.	

Upper Clinton

Herkimer Sandstone

5 ft. 6 in.	Sandstone. Medium gray, calcareous, massive-bedded. Top very irregular. Fossils.	*Crinoid stems* *Leptaena rhomboidalis* *Schuchertella subplana*
2 ft. 6 in.	Red, arkosic, cross-bedded sandstone. No fossils.	
2 ft. 6 in.	Covered.	
2 ft.	Medium gray, very sandy limestone with medium gray calcareous shales. Fossils rare.	*Lingula perovata* *Dalmanella elegantula* *Leptaena rhomboidalis*
3 ft.	Covered.	
2 ft. 6 in.	Red to brown sandstone. No fossils.	
3 ft.	Covered.	
8 ft. 6 in.	Dark gray to medium gray, calcareous, silty, hard shale and thin red sandstone. Wave marks and ripple marks. No fossils.	
1 ft. 6 in.	Medium gray argillaceous limestone.	*Schuchertella subplana* *Stropheodonta profunda*
17 ft. 9 in.	Covered.	
4 ft. 3 in.	Light gray, crystalline, sandy, silty, limestone. Hematitic band near center. Fossiliferous.	*Cladopora seriata* *Fistulipora crustula* *Mesotrypa nummiformis* *Clathropora frondosa* *Rhinopora verrucosa* *Lingula lamellata* *Schuchertella subplana* *S. tenuis* *Atrypa reticularis* *Whitfieldella nitida* *Pentamerus ovalis* *Dawsonoceras annulatum* *Dalmanites limulurus*
16 ft. 8 in.	Covered	
3 ft. 6 in.	Dark gray, calcareous, hard shale. Thin sandy limestone layers. Thin stringers of hematite. Poorly exposed. Contact	*Dictyonema retiforme* *Fenestella elegans* *Eridotrypa solida* *Lioclema asperum* *Acanthoclema asperum*

	gradational and located about 3700 ft. east of road.	*Clathropora frondosa* *Stictotrypa punctipora* *Lingula lamellata* *Dalmanella elegantula* *Homalonotus delphinocephalus* *Cheirurus niagarensis* *Dalmanites limulurus*

Kirkland Iron Ore

4 ft. 7 in.	Red, hematitic limestone. Some layers sandy, some argillaceous. Hematite concentration greater near the center. Some siderite. Fossils only partly replaced.	*Cladopora seriata* *Eridotrypa solida* *Fenestella elegans* *Acanthoclema asperum* *Schuchertella subplana*

DAWES QUARRY CREEK SECTION 33

Town of Kirkland. County of Oneida. Located east of the main part of the village of Clinton and on a creek which is crossed by a north-south road which forms with the Clinton-Willowvale road the second three corners east of Clinton village. Rock outcrops on both sides of the bridge over that stream.

Top

Upper Clinton

Herkimer Sandstone

5 ft. 6 in.	Light gray, thin-bedded, calcareous sandstone. Wave and ripple marks.	*Crinoid stems*
2 ft.	Green sandy shale. Slightly calcareous. Unfossiliferous.	
3 ft. 4 in.	Light gray, thin-bedded, calcareous sandstone. Shale partings abundant. Bedding irregular.	*Buthotrephis gracilis* *B. palmata* *Strophomena orthididea* *Crinoid stems*
2 ft. 6 in.	Green, silty shale.	*Buthotrephis gracilis* *B. palmata*
6 ft.	Light to medium gray sandstone. Mostly thin-bedded. Shale partings abundant.	*Dalmanella elegantula* *Rafinesquina obscura* *Schuchertella subplana* *Rhynchonella plicatella* *Rhynchotreta cuneata*
2 ft.	Gray sandstone and green shale interbedded. Wave and ripple marks and mud cracks common.	*Buthotrephis gracilis* *B. palmata* *B. ramosa* *Rusophycus biloba* *R. subangulatum*
1 ft. 6 in.	Light gray sandstone with shale partings. Quite fossiliferous.	*Dalmanella elegantula* *Leptaena rhomboidalis* *Rafinesquina obscura*

		Schuchertella subplana *Stropheodonta profunda* *Strophomena orthididea* *Pentamerus ovalis* *Rhynchotreta cuneata* *Pterinea emacerata* *Modiolopsis ovata* *M. subcarinata*
3 ft.	Green, silty shale with thin sandstone layers. Mud cracks common. Unfossiliferous.	
13 ft. 9 in.	Light gray sandstone becoming calcareous toward the base. Some sandy limestones in basal portion. Shale partings common. Fossiliferous. Hematitic stringers common near the base. Contact gradational and located 750 ft. downstream from road.	*Cladopora seriata* *Fenestella elegans* *Dalmanella elegantula* *Leptaena rhomboidalis* *Rafinesquina obscura* *Schuchertella subplana* *Stropheodonta profunda* *Strophomena orthididea* *Pentamerus ovalis* *Rhynchotreta cuneata* *Cuneamya alveata* *Ctenodonta elliptica* *Leptodesma rhomboideum* *Pterinea emacerata* *Modiolopsis ovata* *M. subcarinata* *Strophostylus cancellatus* *Conularia niagarensis* *Dawsonoceras annulatum* *Calymene niagarensis* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Paraechmina postica* *P. spinosa* *Dizygopleura proutyi* *Beyrichia veronica*

Kirkland Iron Ore

5 ft. 2 in.	Red, hematitic limestone. Hematitic content variable. Contact abrupt.	*Cladopora seriata* *Fistulipora crustula* *Eridotrypa solida* *Fenestella elegans* *Acanthoclema asperum* *Clathropora frondosa* *Schuchertella subplana*

Dawes Sandstone

8 ft.	Light gray, massive, cross-bedded sandstone. Unfossiliferous. Upper part stained red due to ground water. Contact unconformable.	

No further outcrops in the bed of the stream. About 1500 feet below the road on the east side of the stream are the old open cuts of the Franklin iron ore mine. The ore was worked by the open cut

method until the overburden became too great, then underground methods were employed.

Upper Clinton

Willowvale Shale

18 ft. 4 in.	Green, calcareous shale with thin limestone layers. Shale poorly exposed due to weathering.	*Palaeocyclus rotuloides* *Dictyonema gracilis* *D. retiforme* *Retiolites venosus* *Monograptus clintonensis* *Lingula lamellata* *Pholidops squamiformis* *Dalmanella elegantula* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Chonetes cornutus* *Scenidium pyramidale* *Camarotoechia acinus* *Atrypa reticularis* *Cyrtia meta* *Spirifer radiatus* *Coelospira sulcata* *Ctenodonta mactriformis* *Leptodesma rhomboidea* *Pterinea emacerata* *Cyclonema varicosum* *Orthoceras bassleri* *Dawsonoceras annulatum* *Calymene clintoni* *C. niagarensis* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Beyrichia* aff. *lakemontensis* *Dibolbina* n. sp.

Westmoreland Iron Ore

3 ft.	Red, oolitic iron ore with a shale parting near the center. Poorly exposed. Much talus had to be removed in making the estimate of thickness. All the fossils listed come from shale parting.	*Palaeocyclus rotuloides* *Lingula lamellata* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Chonetes cornutus* *Atrypina disparilis* *Spirifer radiatus* *Coelospira sulcata* *Calymene clintoni* *C. niagarensis* *Dalmanites limulurus lunatus*

WILLOWVALE SECTION 34

Town of New Hartford. County of Oneida. A very good section is exposed by the creek which flows east into Sauquoit creek at Willowvale. The rock is found in the stream bed and in cliffs along the stream. There are three artificial lakes, which cover some rock, but by studying both the stream bed and cliffs a nearly complete section can be obtained. The area of outcrop was once used as a picnic ground which was known in the past as Roger's Glen.

Top

Upper Clinton

Herkimer Sandstone

41 ft. 6 in.	Light gray, slightly calcareous sandstone. Lowest layer more calcareous. Some sandy limestone. Mostly thin-bedded stringers of hematite in basal part. This part of the section is found above the natural falls. A cliff above the falls about 2500 ft. west of main street in Willowvale, exposes much of section. Contact gradational.	*Buthotrephis ramosa* *Palaeophycus striatum* *Rusophycus biloba* *R. subangulatum* *Cladopora seriata* *Rafinesquina obscura* *Schuchertella subplana* *Stropheodonta profunda* *Pentamerus ovalis* *Rhynchonella plicatella* *Rhynchotreta cuneata* *Mytilarca mytiliformis* *Modiolopsis ovata* *M. subcarinatus* *Orthoceras clavatum* *Dawsonoceras annulatum* *Homalonotus delphinocephalus* *Dalmanites limulurus* *Dizygopleura proutyi*

Kirkland Iron Ore

4 ft. 2 in.	Red, hematitic limestone. Some pyrite and siderite. Fossils abundant. Fossils not dwarf. This limestone forms cap rock of the falls. Contact unconformable.	*Cladopora seriata* *Eridotrypa solida* *Fenestella elegans* *Acanthoclema asperum* *Stictotrypa punctipora* *Leptaena rhomboidalis* *Rafinesquina obscura* *Schuchertella subplana* *Stropheodonta profunda* *Atrypa reticularis* *Homalonotus delphinocephalus* *Dalmanites limulurus*

Willowvale Shale

2 ft. 10 in.	Bluish gray calcareous shale. Shale crumbles rather than breaks parallel to any bedding. Fossils abundant but poorly preserved. Many broken. May represent a reworking of lower shale. Contact gradational.	*Mesotrypa nummiformis* *Dalmanella elegantula* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella subplana* *Chonetes cornutus* *Camarotoechia neglecta* *Atrypa reticularis* *Spirifer radiatus* *Nucleospira pisiformis* *Whitfieldella intermedia* *Coelospira sulcata* *Ctenodonta machaeriformis* *Pyrenomoeus cuneatus* *Cyclonema varicosum* *Strophostylus cancellatus* *Dawsonoceras annulatum* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis*

18 ft. 3 in.	Greenish gray shale with thin limestone layers near the base. Thin-bedded and splits parallel to the bedding planes. The lowest layer outcrops 20 ft. downstream from the dam which forms the second lake about 2025 ft. west of the main street of Willowvale.	*Palaeocyclus rotuloides* *Chaetetes lycoperdon* *Dictyonema gracilis* *D. retiforme* *Retiolites geinitzianus venosus* *Monograptus clintonensis* *Ceramopora imbricata* *Eridotrypa striata* *Fenestella elegans* *Semicoscinium tenuiceps* *Acanthoclema asperum* *Rhinopora verrucosa* *Dalmanella elegantula* *Bilobites biloba* *Leptaena rhomboidalis* *Sowerbyella transversalis* *Schuchertella elegans* *S. subplana* *S. tenuis* *Strophonella patenta* *Chonetes cornutus* *Camarotoechia neglecta* *Rhynchonella bidens* *Atrypa nodostriata* *A. reticularis* *Spirifer radiatus* *Nucleospira pisiformis* *Coelospira sulcata* *Cuneamya alveata* *Ctenodonta machaeriformis* *Pyrenomoeus cuneatus* *Leptodesma rhomboidea* *Pterinea emacerata* *Hormotoma subulata* *Cyclonema varicasum* *Orthoceras annulatum* *Dawsonoceras annulatum* *Calymene clintoni* *Dalmanites limulurus* *Mastigobolbina punctata* *M. trilobata* *M. typus* *Plethobolbina typicalis* *Beyrichia* aff. *lakemontensis*
6 ft.	Covered. The topography is such that it can not be uncovered without an enormous amount of work. Pieces of oolitic ore were found in the stream and along the steep banks, but its exact location could not be determined. This area is found at the dam which forms the second lake.	

Middle Clinton

Sauquoit Shale

19 ft. 9 in.	Bluish green, fissile, sandy shale. Thin sandstone layers. Poorly exposed.	
8 ft. 6 in.	Bluish green, fissile, sandy shale. Thin sandstones abundant. Well-exposed. Very fossiliferous. Exposed in	*Chaetetes lycoperdon* *Leptaena rhomboidalis* *Chonetes cornutus* *Coelospira hemispherica* *Pterinea emacerata*

	stream bed between first and second lake.	*Diaphorostoma hemisphericum* *Conularia niagarensis* *C. longa* *Zygobolbina conradi* *Mastigobolbina clarkei* *M. lata* *M. lata* var. *nana* *M. vanuxemi*
20 ft. 4 in.	Bluish green, fissile, sandy shale. Poorly exposed. Last outcrop about 100 ft. below first dam.	
8 ft. 9 in.	Greenish gray, very sandy shale. Sandy limestone layers near center. Irregular conglomeratic masses common. Wave and ripple marks and mud cracks. Fossils rare. Some excellent ostracods.	*Zygobolbina conradi* *Mastigobolbina lata* *M. lata* var. *nana*
9 ft.	Greenish gray, slightly calcareous shale. Mud cracks common. Very fossiliferous.	*Leptaena rhomboidalis* *Chonetes cornutus* *Atrypa reticularis* *Atrypina disparilis* *Leptodesma rhomboideum* *Amphicoelia orbiculoides* *Cyclonema varicosum* *Bucanella trilobata* *Calymene clintoni* *C. niagarensis* *Dalmanites limulurus lunatus* *Zygobolbina conradi* *Mastigobolbina lata* *M. lata* var. *nana* *M. vanuxemi*
4 ft. 6 in.	Green and greenish gray, very sandy shale with thin-bedded green, argillaceous sandstone. Conglomeratic masses common. Fossils rare and poorly preserved.	
7 ft. 9 in.	Green, silty, slightly calcareous, sandy shale. Conglomeratic masses present. Poorly exposed.	
1 ft. 3 in.	Light to medium gray, quartz conglomerate. Some phosphatic material.	
12 ft. 7 in.	Bluish gray, slightly calcareous, slightly sandy shale. Thin-bedded. Some mud cracks and wave and ripple marks. Very fossiliferous.	*Leptaena rhomboidalis* *Chonetes cornutus* *Coelospira hemispherica* *Ctenodonta machaeriformis* *Cyrtodonta alata* *Leptodesma rhomboideum* *Pterinea emacerata*

Amphicoelia orbiculoides
Bucanella trilobata
Cyclonema varicosum
Calymene clintoni
Dalmanites limulurus lunatus
Zygobolbina conradi
Mastigobolbina lata
M. lata var. ***nana***
M. vanuxemi

1 ft. 6 in. Light to medium gray conglomerate. May be beginning of Oneida. Conglomerate located 350 ft. upstream from main street of Willowvale.

DESCRIPTION OF DIAMOND DRILL CORES

The eight state-owned diamond drill cores were loaned to the writer through the courtesy of C. A. Hartnagel. They were a great aid not only in determining the lithology and thickness of the various Clinton formations, but also in correlating and giving the stratigraphic position of many of the small isolated outcrops many of which otherwise would have been useless.

The lithology and fossil content of the cores are described on the following pages. The cores are designated by letters A to H. Their location is shown on the accompanying map (figure 1, page 7).

Wallington Drill Core — Section A

Town of Sodus. County of Wayne. The test hole is located on the west bank of Salmon creek 90 feet north of United States Highway 104.

Top

Pleistocene and Recent

2 ft. 6 in. Soil.

Upper Clinton

Rochester Shale

67 ft. 6 in. Brownish gray, calcareous shale with many argillaceous limestone layers. The lower part is a dark gray shale with light gray limestone members. Very fossiliferous. Contact sharp.

Irondequoit Limestone

8 ft. 2 in. Crystalline, light gray limestone layers with shale layers. Crinoid stems abundant. *Whitfieldella intermedia* common. Contact gradational.

10 ft. 1 in. Bluish gray calcareous shale with limestone members. *Mastigobolbina trilobata.* Contact gradational.

Williamson Shale

18 ft. 6 in. Green fissile shale, the basal part of which contains black layers. Thin limestone layers present. Some limestone composed of *Sowerbyella transversalis*. *Monograptus clintonensis* plentiful.

At base of Williamson a few inches of column are missing. May represent the unconformity noted on Second creek.

Lower Clinton

Wolcott Limestone

2 ft. 10 in. Bluish gray shale. Thin-bedded. No *Pentamerus*. Probably Wolcott Furnace iron ore horizon.

14 ft. 6 in. Bluish gray limestone. Some layers crystalline. Thin shale layers common. *Pentamerus oblongus* occurs at four horizons. First upper 9 in., second 17 in. layer 34 in. from the top, third 4 ft. with *Pentamerus* throughout 68 in. from the top, fourth occurs at the very base of the limestone.

Upper Sodus Shale

2 ft. 10 in. Transition limestone and shale. Limestone predominates at the top, shale at the base.

34 ft. 9 in. Green, calcareous shale with limestone layers. These limestones commonly called pearly layers. Composed almost entirely of *Coelospira hemispherica*. *Zygobolba decora* is common. In drawing the line between this shale and the one below a careful search for ostracods was made. It was found that the shale above the 6-in. pearly layer contained *Zygobolba decora* and that below had *Zygolbolba excavata* and *Zygobolba prolixa*. This 6-in. pearly layer appears to occur at the same horizon that the 7-in. pearly layer occupies on Salmon creek. Contact sharp.

Lower Sodus Shale

16 ft. 2 in. Green and dark gray or purple shale. Upper part predominately green. Lower part predominately dark gray. Limestone layers composed of *Coelospira hemispherica* common. The most common ostracods in the upper part *Zygobolba excavata* and *Zygobolba prolixa*. In the basal part *Zygobolba curta* predominates. At the base is a one-inch band of hematitic material. Contact sharp.

Reynales Limestone

12 ft. 6 in. Dark to light gray limestone. The upper part thin-bedded. The upper and middle portions contain an abundance of chert. *Pentamerus oblongus* characteristic. Contact gradational.

Furnaceville Iron Ore

2 ft. 6 in. Limestone with hematite. The hematitic content is not high at any one point, but the lower 11 in. contains the most. Contact sharp.

Thorold Sandstone

5 ft. Green-gray, shaly, calcareous sandstone. The upper part has black phosphatic nodules. Some of the sandstone layers have clay pellets imbedded in them.

Albion Group

Grimsby Sandstone

Red sandstone.

WOLCOTT DRILL CORE SECTION B

Town of Wolcott. County of Wayne. Test hole is located north of the falls at Wolcott and on the east bank of Wolcott creek.

Top

Pleistocene and Recent

5 ft. 6 in. Soil.

Upper Clinton

Rochester Shale

39 ft. Brown and gray calcareous shale with many limestone layers. Very fossiliferous. Contact sharp.

Irondequoit Limestone

6 ft. 2 in. Gray crystalline limestone. A few layers crinoidal.

28 ft. 6 in. Bluish gray, calcareous shale with limestone members. Shale crumbles rather than cleaves. Contact gradational.

Williamson Shale

22 ft. 9 in. Green fissile shale with some dark colored layers near the base. Few limestone layers most of which are less than 2 in. thick. *Sowerbyella transversalis* abundant in limestones. *Atrypa reticularis* and *Monograptus clintonensis* abundant in shales.

Unconformity pronounced.

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. Hematitic limestone. Concentration greatest in lower 6 in. Contact gradational.

Wolcott Limestone

19 ft. 6 in. Bluish gray limestone. Many bluish gray calcareous shale layers. *Pentamerus oblongus* at three horizons. Contact gradational.

Upper Sodus Shale

42 ft. 6 in Green, calcareous shale. Some layers near top bluish gray in color. Pearly layers common and reach a thickness of 5 in. Also some crystalline limestones. Shales abound in *Coelospira hemispherica, Stropheodonta corrugata, Zygobolba decora* and *Zygobolba robusta.* Contact questionable.

Lower Sodus Shale

19 ft. 6 in. Greenish gray shale with dark gray or purple shale abundant at base. Crystalline limestone layers present. None of the limestones are pearly. Shale contains *Coelospira hemispherica, Tentaculites minutus, Zygobolba curta, Zygobolba prolixa* and *Zygobolba excavata.* At the base is a 2 in. layer of hematitic limestone. Ore marks an abrupt change in lithology. Contact sharp.

Reynales Limestone

12 ft. 2 in. Alternating gray limestone and dark gray shale. The upper 20 in. contains fossils, *Pentamerus oblongus*. The middle portion cherty. The lower 2 ft. has tiny stringers of hematite. Contact gradational.

Furnaceville Iron Ore

2 ft. 9 in. Hematitic limestone interbedded with shale. Hematite is concentrated at top and bottom, the two layers being separated by a shaly limestone. Contact sharp.

Thorold Sandstone

2 ft. 1 in. Shaly, calcareous sandstone. The middle portion a green, platy shale. The upper 8 in. a green, sandy shale with fine-grained nodules of phosphatic material.

RED CREEK DRILL CORE SECTION C

Town of Sterling. County of Cayuga. Test hole is located just to the north of the improved Red Creek-Sterling Station road, two miles northeast of Red Creek and three miles southwest of Sterling Station. The well was drilled on the bank of one of the minor branches of Blind Sodus creek.

Top

Pleistocene and Recent

9 ft. Soil and glacial drift.

Upper Clinton

Rochester Shale

14 ft. Brown and gray calcareous shale interbedded. Some argillaceous limestone.

Irondequoit Limestone

6 ft. Gray, argillaceous limestone. The basal part a pure crystalline limestone. The central portion a calcareous shale. The upper 15 in. is very fossiliferous, *Whitfieldella cylindrica*. *Mastigobolbina punctata* found near center. Contact gradational.

29 ft. 4 in. Gray, calcareous shale with a few argillaceous limestone members. Some layers fissile. Fossiliferous but none identified.

Williamson Shale

31 ft. 6 in. Green and gray fissile shale. A few black layers in the lower and central portions. Some thin limestones composed entirely of *Sowerbyella transversalis, Monograptus clintonensis* and *Dibolbina* n. sp. common in shale layers.

Unconformity clearly marked.

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. 4 in. Bluish gray, calcareous shale. Oolites of hematite. Phosphatic nodules. One inch of oolitic iron cre at base. Contact gradational.

Wolcott Limestone

16 ft. 10 in. Light gray limestone with some bluish gray, calcareous shale layers. Much of limestone argillaceous. *Pentamerus oblongus* at two horizons. *Pentamerus* only in crystalline limestone. Contact gradational.

Upper Sodus Shale

44 ft. 1 in. Greenish gray, calcareous shale with bluish gray shale layers in upper part. Some dark gray shales near base. Pearly limestone layers especially in upper part. The shales contain *Coelospira hemispherica, Zygobolba decora* and *Zygobolba robusta.* Contact not easily distinguished.

Lower Sodus Shale

21 ft. 6 in. Purplish gray shale with some greenish gray shale. Many thin limestone layers. One is 13 in. thick, but most are less than 4 in. thick. Limestones in upper part pearly. Limestones in lower part crystalline with brownish color. Four-inch hematitic layer at the base. *Zygobolba excavata* present.

Reynales Limestone

10 ft. 10 in. Dark gray or purple shale and dark gray argillaceous limestones. The upper 2 in. is fossiliferous. In the shale near center *Zygobolba curta* was identified.

Furnaceville Iron Ore

2 ft. 6 in. Red hematitic fossiliferous limestone. Two inches of shale near center.

Thorold Sandstone

3 ft. 6 in. Greenish gray, calcareous shaly sandstone. The upper 8 in. very shaly.

MARTVILLE DRILL CORE SECTION D

Town of Sterling. County of Cayuga. The test hole is located on the west bank of Little Sodus creek and 15 rods north of the main highway to Hannibal.

Top

Pleistocene and Recent

18 ft. Glacial till.

Lower Clinton

Upper Sodus Shale

35 ft. Greenish gray shale with some dark gray shale layers becoming more abundant toward the base. Pearly limestone especially abundant in the lower part of the upper half. Some crystalline unfossiliferous limestones. *Coclospira hemispherica* and *Tentaculites minutus* in shale. *Zygobolba decora* also present. No definite break at base. Contact drawn where dark gray dominates. Ostracods aid in determining contact.

Lower Sodus Shale

30 ft. 6 in. Dark gray or purple shale with limestone lenses. Thin limestones common. Limestones crystalline, some with brownish color. The shales contain *Phaenopora ensiformis, Coelospira hemispherica, Zygobolba excavata* and *Zygobolba curta.* Contact sharp.

Bear Creek Shale

10 ft. 1 in. Dark gray or purplish shales with some interbedded argillaceous limestones. Shale layers contain pelecypods and *Coelospira hemispherica.* The top is marked by 1 in. of hematitic material Stringers of hematite in basal 2 ft. Contact gradational.

Furnaceville Iron Ore

3 in. Red hematitic argillaceous limestone. Black phosphatic nodules common at base.

Thorold Sandstone

4 ft. 2 in. Gray, argillaceous, calcareous sandstone. Upper part interbedded with green shale.

South Granby Drill Core — Section E

Town of Granby. County of Oswego. The test hole is located one and a half miles north of Little Utica and one mile southwest of South Granby on the west side of the north-south road and just north of the little stream which crosses the road at that point.

Top

Pleistocene and Recent

22 ft. Soil, sand and gravel.

Upper Clinton

Rochester Shale

16 ft. 9 in. Brownish gray, calcareous shale. Very fossiliferous. Contact sharp.

Irondequoit Limestone

8 ft. Dark gray, argillaceous limestone. Upper part very fossiliferous. Crinoid stems. *Whitfieldella cylindrica.* Contact gradational.

3 ft. 2 in. Dark gray, tough, calcareous shale. Sparingly fossiliferous. *Mastigobolbina trilobata.* Contact sharp.

1 ft. 9 in. Crystalline crinoidal limestone. Contact gradational.

9 ft. 1 in. Dark gray argillaceous, some pyritic limestone. Shale partings abundant. Fossiliferous. Contact gradational.

Williamson Shale

18 ft. 6 in. Dark green to gray massive calcareous shale with some thin limestone layers. Toward base limestone filled with *Sowerbyella transversalis. Monograptus clintonensis* in shales. Contact sharp.

7 ft. 3 in. Blue to brown calcareous shale. Thick-bedded. *Mastigobolbina punctata.*

15 ft. 3 in. Dark greenish gray fissile shale. A very few thin limestones. *Monograptus clintonensis, Sowerbyella transversalis.* Basal few inches very pyritic with a thin stringer of hematitic limestone. Contact sharp.

Middle Clinton

Sauquoit Shale

16 ft. 4 in. Dark brownish gray to brown shale. Some thin-bedded, and fissile. Some near center calcareous. Thin limestone at top. Contact gradational.

16 ft. 8 in. Dark gray fissile shale. Very thin layers of limestone or calcareous material at base. Contact sharp.

Lower Clinton

Wolcott Limestone

11 in. Light gray limestone, largely composed of crinoid stems. Hematite abundant in the upper part where it replaces fossils.

2 ft. 7 in. Bluish gray calcareous shale. Lacy bryozoans abundant.

6 in. Argillaceous oolitic hematitic iron ore.

8 in. Bluish gray calcareous shale with thin limestone layers.

10 in. Light gray fossiliferous limestone. An abundance of hematite especially near center.

4 ft. 6 in. Light gray, fossiliferous limestone with shale partings. *Pentamerus oblongus.*

6 ft. 2 in. Light gray, dense crystalline limestone with an abundance of shale partings. Contact gradational.

Upper Sodus Shale

2 ft. 4 in. Light bluish gray shale with dense limestones.

39 ft. 8 in. Greenish gray calcareous shale. Some light bluish gray at top. Dark gray shale abundant at the base. Thin pearly limestone layers especially abundant in the upper half. Some brownish crystalline limestone near base. *Coelospira hemispherica* abundant. *Tentaculites minutus, Zygobolba decora, Zygobolba robusta* and *Mastigobolbina incipiens.* Contact indefinite. Drawn on basis of ostracods and change in lithology.

Lower Sodus Shale

20 ft. Dark gray, slightly calcareous, fossiliferous shale with a few limestone layers, none of which are pearly. Pelecypods noted in basal portion. *Coelospira hemispherica* and *Zygobolba excavata* also identified. Contact sharp.

Bear Creek Shale

9 ft. 10 in. Dark gray, slightly calcareous shale with argillaceous limestone. Basal portion slightly sandy. Contact gradational.

Furnaceville Iron Ore

8 in. Red argillaceous hematitic limestone.

Thorold Sandstone

4 ft. 3 in. Green argillaceous, calcareous sandstone with shale layers. Phosphatic nodules abundant.

BREWERTON DRILL CORE SECTION F

Town of Cicero. County of Onondaga. The test hole is located on the south bank of Oneida river about 230 feet west of the bridge on United States Highway 11.

Top

Pleistocene and Recent

14 ft. Clay.

Upper Clinton

Williamson Shale

5 ft. 4 in. Dark green, fissile shale with thin limestones composed of *Sowerbyella transversalis.* 4 in. layer with glauconite and phosphatic nodules at base. Contact sharp.

Middle Clinton

Sauquoit Shale

14 ft. 4 in. Dark bluish green fissile silty shale.

16 ft. 6 in. Dark green thinly laminated shale. Some slightly calcareous. Thin crystalline unfossiliferous limestones common.

6 ft. 2 in. Dark bluish gray calcareous sandy and silty shale with some thin limestones and thin partings of sandstone. Contact sharp.

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. 11 in. Red hematitic limestone stringers in a bluish gray, sandy and calcareous shale. Upper 2 in. show greatest concentration of hematite. Lacy bryozoans abundant. Contact gradational.

Wolcott Limestone

14 ft. 3 in. Light gray to bluish gray, very argillaceous limestone with a few crystalline layers. Brownish and bluish gray calcareous shale abundant. Limestone layers unfossiliferous. Many limestones show trace of hematite as thin stringers. Shale layers abound in *Fenestella tenuis, Semicoscinium tenuiceps.* One ostracod, *Mastigobolbina incipiens.* Contact gradational.

Upper Sodus Shale

7 ft. Bluish gray and greenish gray calcareous shales interbedded with thin limestones. Shales show an abundance of *Coelospira hemispherica, Tentaculites minutus, Zygobolba decora, Zygobolba robusta, Mastigobolbina incipiens* and *Mastigobolbina retifera.* Contact gradational.

35 ft. 3 in. Greenish gray, calcareous shale with thin pearly limestone layers. Some dark gray or purple shale in the basal portion. Shales very fossiliferous with *Coelospira hemispherica, Stropheodonta corrugata* and *Zygobolba decora* especially prominent. Contact indefinite.

Lower Sodus Shale

18 ft. 3 in. Dark gray shale with a few greenish gray layers. Thin crystalline limestones, mostly brownish in color, are common. Shale fossiliferous. *Coelospira hemispherica, Pterinea emacerata, Tentaculites minutus, Zygobolba prolixa* and *Zygobolba curta.* Contact sharp but conformable.

Bear Creek Shale

4 ft. 8 in. Dark gray shale with dark gray argillaceous limestones. Top marked by a thin oolitic hematitic limestone. Stringers of hematite found throughout upper 1 ft. 6 in.

8 in. Dark gray argillaceous calcareous sandstone with scattered oolites of hematite. Contact gradational.

Furnaceville Iron Ore

1 ft. 4 in. Red oolitic iron ore. High concentration of hematite.

Oneida Conglomerate

5 ft. 4 in. Light gray argillaceous sandstone grading downward into a quartz conglomerate. A very few green sandy and silty shale partings.

LAKEPORT DRILL CORE SECTION G

Town of Sullivan. County of Madison. The test hole is located one and a half miles northeast of Lakeport and one-quarter of a mile south of Oneida lake.

Pleistocene and Recent

7 ft. Soil and glacial drift.

Lockport

10 ft. 7 in. Dark gray dolomite. Medium bedded.

11 in. Dark gray dolomitic shale.

2 ft. 6 in. Dark gray dolomitic limestone. Contact sharp.

Upper Clinton

Rochester Shale

10 ft. 3 in. Dark brownish gray, calcareous, slightly sandy, tough, fossiliferous shale. Contact sharp.

23 ft. 7 in. Alternating thin-bedded shales with lesser amounts of argillaceous limestone layers. A few crystalline limestones.

11 ft. 7 in. Light gray limestone with some argillaceous limestone layers and an abundance of dark gray calcareous shales. Crystalline limestones usually show trace of hematite. Basal 11 in. contains an abundance of hematite which replaces fossils.

8 ft. 8 in. Dark brownish gray, calcareous shale with an abundance of argillaceous limestones. Shale very fossiliferous.

20 ft. 8 in. Dark gray, sandy, calcareous shale with an abundance of thin calcareous sandstones.

18 ft. 1 in. Dark gray, calcareous shale with argillaceous sandy limestones abundant. A few thin argillaceous sandstones.

15 ft. 2 in. Dark bluish gray calcareous shale with argillaceous limestone layers. Shale layers are very fossiliferous. Contact sharp.

Irondequoit–Williamson

5 ft. 10 in. Dark gray, calcareous limestone with interbedded crystalline limestone layers. Some shale partings. Limestone layers crinoidal. Upper 18 in. hematitic.

11 ft. 4 in. Bluish gray, calcareous shale. Massive bedded with a few very thin crystalline limestone layers. Fossiliferous.

24 ft. 2 in. Thin-bedded dark green, fissile shale with an abundance of thin limestones bearing *Sowerbyella transversalis*. Graptolites very common.

27 ft. 9 in. Dark greenish gray thin-bedded, slightly sandy shale. Basal 3 ft. has a brownish gray color.

11 ft. 5 in. Dark greenish gray fissile shale. *Monograptus clintonensis* abundant. Base marked by a thin sandstone 2 in. to 3 in. thick. Contact sharp.

Middle Clinton

Sauquoit Shale

19 ft. 5 in. Dark green, fissile, slightly sandy and silty shale. *Zygobolbina conradi.*

8 ft. 9 in. Dark gray, slightly sandy shale.

30 ft. 4 in. Dark gray shale. Thin-bedded. Some slightly calcareous. Some slightly sandy. An abundance of thin sandy limestone layers. *Mastigobolbina lata.*

17 ft. Dark bluish gray shale with some thin sandstone layers. Contact sharp.

Lower Clinton

Wolcott Furnace Iron Ore

2 ft. Bluish gray shale with scattered oolites of hematite. Upper surface covered with hematite. Very fossiliferous. Lacy bryozoans.

Wolcott Limestone

8 ft. 8 in. Bluish gray argillaceous limestone with an abundance of bluish gray calcareous shale. A few thin crystalline limestone layers. Thin stringers of hematite common throughout the whole thickness.

1 ft. 10 in. Red hematitic limestone. Upper 8 in. shows high concentration of hematite. Thin shale layers common. Basal 3 in. is an argillaceous sandstone containing considerable hematite. Contact sharp.

Upper Sodus Shale

32 ft. Greenish gray, calcareous shale. Upper portion contains some bluish gray layers. Thin crystalline limestones common, a few of which are pearly. Fossiliferous. *Coelospira hemispherica, Stropheodonta corrugata* and *Zygobolba decora.* Contact sharp and marked by a thin hematitic layer.

Lower Sodus Shale

12 ft. 1 in. Dark gray shale with thin crystalline limestone layers, most of which are brownish in color. *Coelospira hemispherica, Tentaculites minutus* and *Zygobolba excavata.* Contact sharp.

Bear Creek Shale

1 ft. 4 in. Argillaceous limestone. Stringers of hematite throughout. A thin layer of hematite at the top. A layer 7 in. thick near center shows a high concentration of hematite. Branching bryozoans common in hematitic portion. Contact appears sharp.

Furnaceville Iron Ore

4 in. Red, hematitic, fossiliferous iron ore. Fragments of *Coelospira* replaced by hematite. Character of ore and sharpness of contact are bases for separating this lower 4 in. from the Bear Creek shale. Contact sharp.

Oneida Conglomerate

2 ft. 7 in. Gray sandstone with green silty shale layers. Two-inch quartz conglomerate in middle of formation.

VERONA STATION DRILL CORE SECTION H

Town of Verona. County of Oneida. Test hole is located about 300 feet west of the railroad station at Verona Station and on the south side of the highway. It is situated on the bank of a small tributary of Stony creek.

Top

Pleistocene and Recent

18 ft. Sand and Clay.

Middle Clinton

Sauquoit Shale

19 ft. 2 in. Bluish gray sandy shale with thin sandy limestones. Contact sharp.

Lower Clinton

Wolcott Furnace Iron Ore

1 ft. Red hematitic limestone. Fossils abundant. Contact sharp.

Upper Sodus Shale

36 ft. 2 in. Greenish gray shale with thin limestones in the upper part. Thin sandstones are abundant near the base of the formation. Shales fossiliferous. *Coelospira hemispherica, Strophcodonta corrugata* and *Zygobolba decora.* Contact gradational.

Oneida Conglomerate

10 ft. White sandstones interbedded with green sandy shales. Some conglomeratic layers especially near base.

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